VOL. XVI. No. 11. NOVEMBER 1929.

MECCANO MAGAZINE

TRANSPORT BY ELECTRIC TELPHER

(See page 834)

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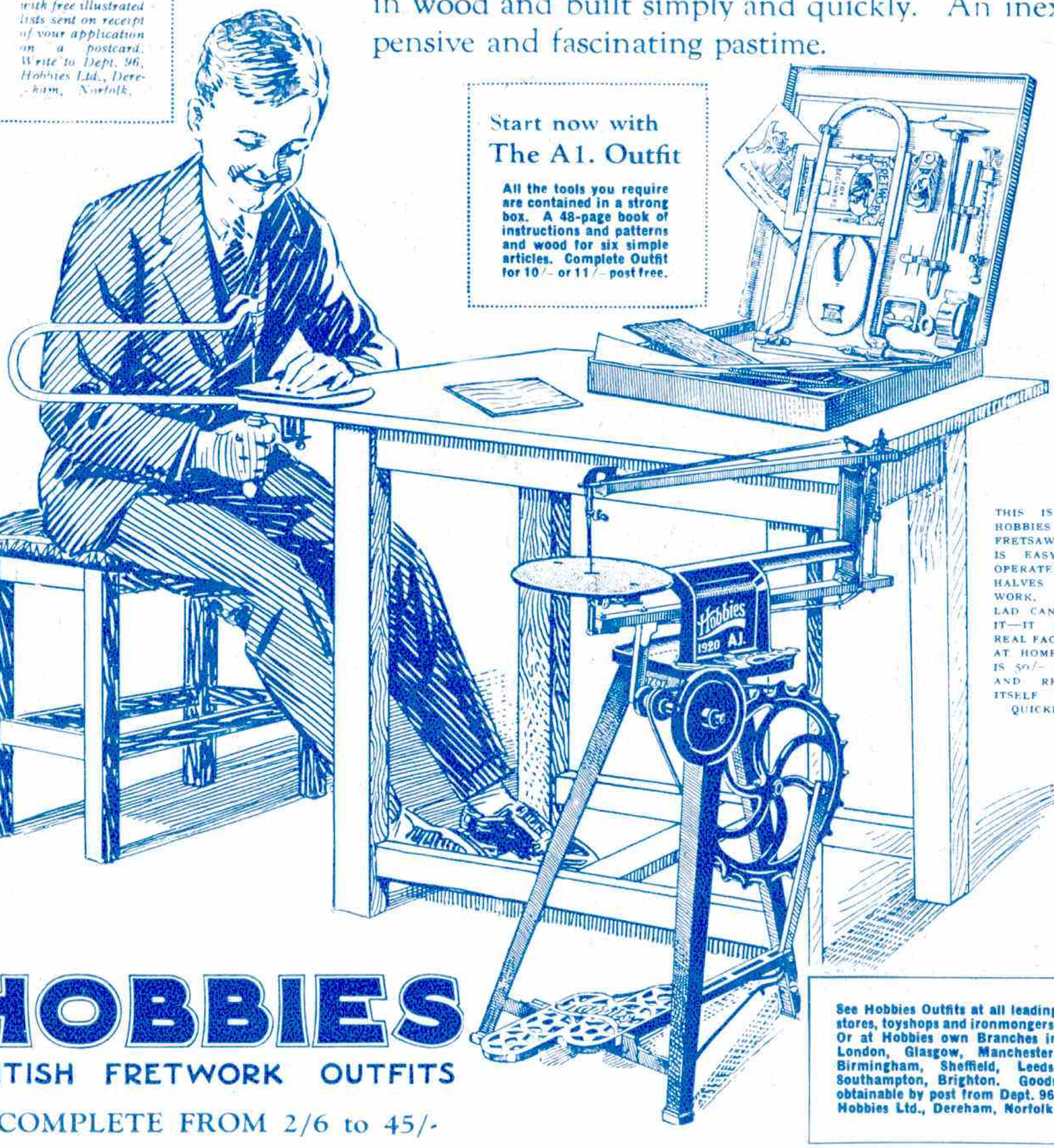

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With the Editor

"The Fifth of November"

In spite of the gloomy days and fogs for which the month of November is famous, thousands of my readers always greet it with enthusiasm, for it brings the one night of the year on which they have the privilege of making as much noise as they please! The "Fifth of November" is sacred to bonfires and fireworks, for on that day the youth of England celebrate the escape of the British Houses of Parliament from destruction by a gigantic firework display, which at that time would have created a world's record.

I am afraid that very few of those who take part in this annual rejoicing stop to think of its origin; they are too busy piling up their fires, sending up rockets and burning effigies of Guy Fawkes, the best known of the men connected with this desperate attempt. This is unfortunate, for the story of this sturdy conspirator is well worth knowing.

Guy Fawkes was not the originator of the great conspiracy to blow up the House of Lords during the presence there of King James I and the Prince of Wales. He was essentially a man of action rather than a plotter. He had fought for twelve years with the Spaniards in Flanders, and he was a soldier of cool and determined courage, who could be relied upon to carry out any enterprise to which he set his mind. He was thus the very man the conspirators wanted, and for him was reserved the extremely dangerous duty of lighting the train that would explode the barrels of gunpowder that had been stored under the House of Lords after long and exhausting labour. The successful accomplishment of this desperate feat was to be the signal for a general rising.

On 4th November, 1605, the day before Parliament was to assemble, the conspirators were suddenly thrown into a great state of alarm by a rumour that their plans had been disclosed to the Government. Most of them fled in panic, and they implored Fawkes to go with them. But Fawkes was a Yorkshireman, gifted with more than the traditional amount of stubborn determination. He had joined the conspiracy with the object of blowing the Scots back to their own country, and he was not the man to withdraw in fright on account of a rumour. Calmly Fawkes hid himself among the barrels of gunpowder and awaited the moment to put his threat into action. He declared that sooner than be deprived of the pleasure of blowing the King to destruction he would blow himself up also.

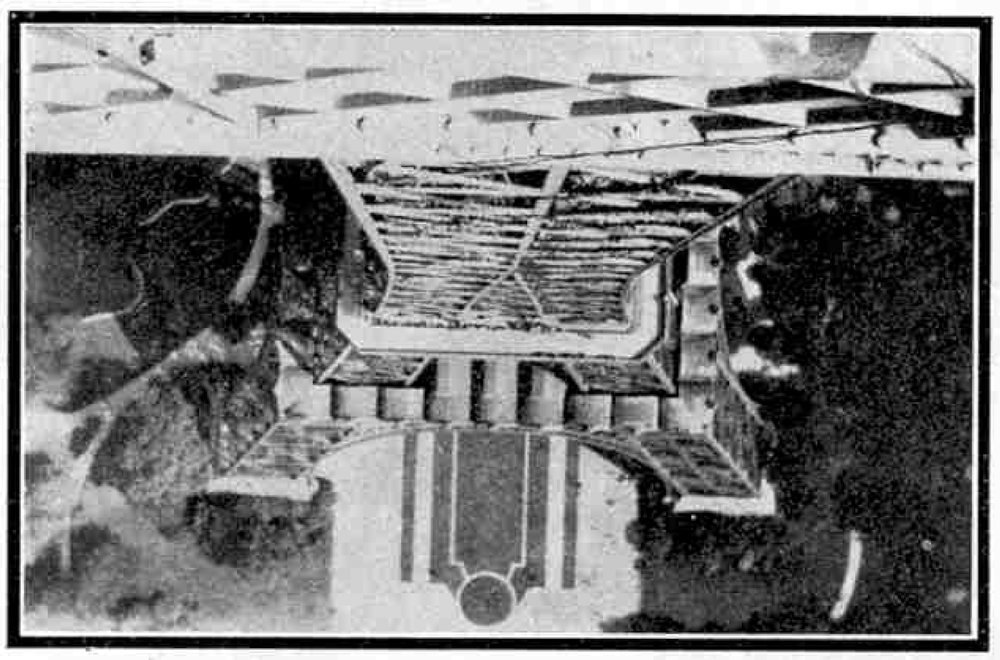
The rumour that suspicion had been aroused turned out to be true. The cellars of the House were searched next morning, and Fawkes was discovered. Even then such was his courage that it was only with the greatest difficulty that he was prevented from exploding the gunpowder by which he had sat throughout the night, with a burning slow match in his hand.

Courage Devoted to Wrong Use

In spite of the dastardly nature of his intended crime it is impossible to help admiring Fawkes for his indomitable courage, particularly after his capture. He was shut up in a cell in which he could stand but could not lie down, and subsequently was stretched on the rack after enduring what were described as "gentler tortures." In spite of the fearful agony that he suffered he steadfastly refused to divulge the names of his fellow conspirators. The only reply he gave to the questions put to him when under torture was a repeated avowal of his purpose of getting rid of the King because he had continued the penal laws against Catholics that had been passed during the reign of Elizabeth. Finally Fawkes was dragged on a hurdle from the Tower to the Parliament House and there hanged.

To me, the career of Guy Fawkes seems a typical instance of splendid qualities put to wrong use. Certainly there never was a braver man, and if his wonderful courage and determination could have been applied along right lines he might have achieved almost anything. In many respects Fawkes had the qualities of a Cromwell, but he had also some criminal streak in his composition that led him to underground conspiracies of a type into which Cromwell would never have entered. The result is that to-day Cromwell occupies a place of honour as one of England's greatest men, while Guy Fawkes is remembered only as a would-be murderer, and is burned in effigy every "Fifth of November."

No. 12. WHAT EVER IS IT?



Here is the twelfth puzzle in this series of mystery photographs. To the first reader who identifies exactly this mysterious-looking object, or to the reader who gets nearest, I will send an autographed copy of my new book "Wonders of Engineering."

Solutions should be written on postcards only and addressed "Editorial Competition No. 12," Meccano Magazine, Old Swan, Liverpool. Closing date 29th November.

Our "Careers" Section

On page 856 of this number appears the first of the series of detailed articles on choosing a career. Last month the series was introduced by a general survey of the whole field of engineering, and this month's article deals with the mechanical branch of this profession. The best means of entering upon this career and the nature of the training required are indicated as far as is practicable within the limits of a single article. I hope that any reader who does not find in the article exactly what he requires, will write to me at once, explaining fully his position. I will then do my utmost to give the advice required in each individual case.

Mystery Photograph No. 11

At the time of going to press only one competitor had succeeded in identifying the October photograph correctly as "an end view of a lead pencil, fitted with pocket clip." This keen-eyed competitor is B. Powell, 82, Belmont Road, Beckenham, to whom an autographed copy of my new book "*Wonders of Engineering*" has been sent.

Transport By Electric Telpher

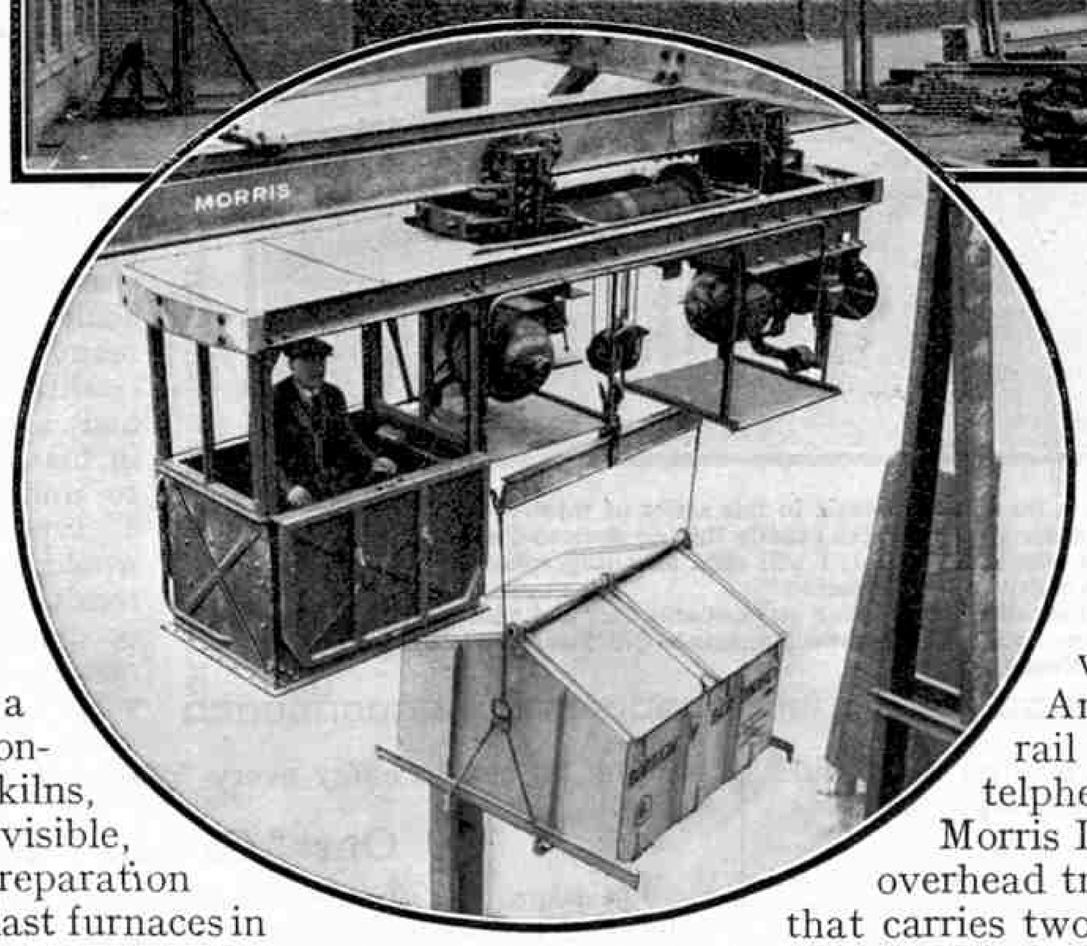
The Possibilities of Overhead Traction

THE means of transport with which we are most familiar involves the use of a prepared track along the ground, either a rail track or a roadway. The construction of a track of this nature is always a costly proceeding, and in certain circumstances the expenditure would not be justified by the amount of traffic. In addition the nature of the ground may be such as to make the construction of a rail or roadway almost impossible, and sometimes there is not sufficient free space available for permanent occupation.

There are various ways of overcoming the difficulties just mentioned, and among the most practicable and interesting of these is the installation of overhead transport. This is comparatively cheap to construct and operate, and among other advantages it does not interfere with any operations that may be necessary on the ground below. An excellent example of the value of overhead transport is shown on our cover, which represents a scene in a modern ironworks. In the huge kilns, of which three are visible, iron ore is roasted in preparation for transport to the blast furnaces in which smelting is carried out. The roasted ore is carried away by electric trolleys that run on overhead rails and, as the cover shows, these come and go above the heads of the workmen without causing any interruption of work.

Modern electric runways, or telphers as they are generally called, have been developed from very simple types of runway introduced during last century. In these early examples the loads were carried by trolleys that were hauled along on their overhead rails by hand. In order to enable the loads to be swung clear of the ground, hoisting tackle was provided. The weights to be moved were often very large, and it was therefore necessary to use slow-moving tackle that gave a large mechanical advantage. It was not long before a quicker lift was demanded by users, and this was supplied by attaching an electric hoist to the push trolley of the runway. After this it was only a step to speed up matters still further by the addition of a second electric motor to operate the trolley itself.

Originally current was supplied to the trolley by means of a long flexible cable, which was allowed to trail on the ground. This was a very inconvenient and indeed dangerous arrangement. Some improvement was brought about by using a shorter cable provided with a plug that could be inserted in one of numerous outlets arranged at points along the track. Later this clumsy method was abandoned, and copper wires were fixed alongside the runway in order that the current could be supplied continuously. Experience showed that something more substantial than copper wire was necessary, however, and finally steel rails were brought into use.



Electric telpher system in use. The trolley-hoists travel on rails erected at a convenient height

Below: Close-up view of trolley-hoist showing the two motors

An excellent example of a modern overhead rail system of this description is the electric telpher designed and manufactured by Herbert Morris Ltd., Loughborough. This consists of an overhead track on which runs a travelling carriage that carries two separate electric motors. One of these motors is geared to the driving wheels that travel on the rail, and the other operates the lifting gear by means of which the carriage picks up loads from the ground or lowers them for delivery. The two functions of the travelling carriage are admirably summed up in the name "trolley-hoist" that is usually given to it.

Current is supplied to the motors by means of a pair of conductor rails that run parallel to the track. These are of steel, and are T-shaped in section. Two are necessary, for the rails on which the trolley-hoists run are not used as return conductors.

Usually the motors are controlled from a cab attached to the trolley-hoist. In some instances no cab is used,

and the movements of the trolley-hoist are then directed by a man or boy who walks along the ground and manipulates chains that operate the controlling gear. This is not a very satisfactory arrangement, and in many cases the speed at which the trolley-hoist is designed to travel, or the irregular nature of the ground beneath the electric telpher, makes it impossible.

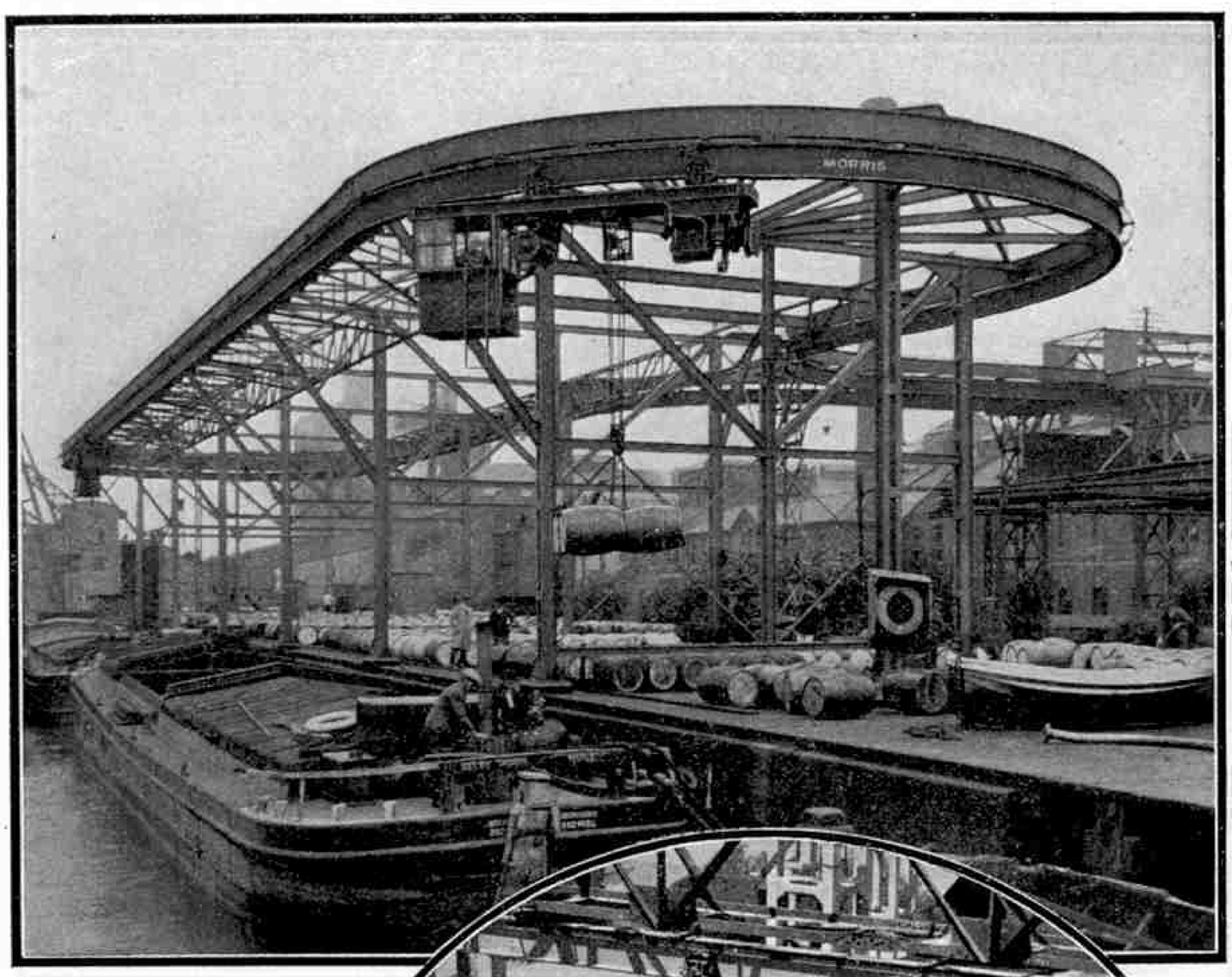
The track of a telpher may follow a straight line or it may be curved in order to avoid obstructions or to take any convenient direction. A very common arrangement is to have a trunk or main line with branches jutting out in convenient places. The passage from one line to another is made by means of curved rails or switches. These are similar to the points used on railway tracks and are operated by chains that hang in positions easily reached by the drivers of the trolley-hoists. When a trolley-hoist is switched on to a branch line in this manner an automatic stop closes the end of the main track thus left free, until the switch is restored to its normal position.

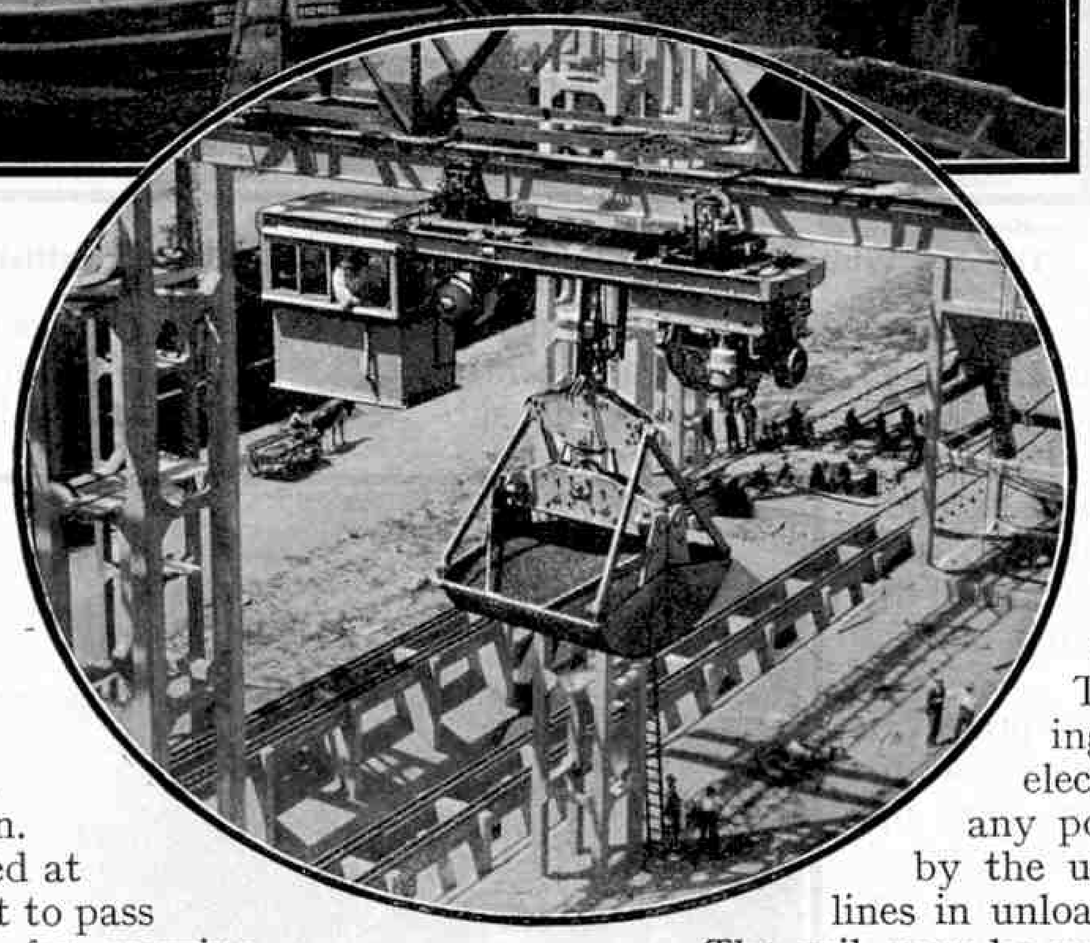
The greatest advantage of an electric telpher is that it occupies very little more than air space, which is cheap and not in very great demand. One may be constructed wherever there is room for the passage of a trolley-hoist and space for the erection of the narrow track and its supporting posts, for a trolley-hoist is an independent unit that may follow any curve or cross any junction in either a forward or a reverse direction. The rails on which it runs may be erected at any convenient height, either to enable it to pass over low buildings or to leave room for growing dumps of waste material or accumulating piles of stock. They may be erected across rivers, canals, and railway tracks—in fact anywhere; and when in operation they do not interfere with work carried on below.

Electric telphers have been found especially useful in the transport of goods of all types from one portion of a factory to another. Inter-departmental transport is often difficult, especially in factories that have been extended or have not been specially planned with this end in view, and may be the cause of much loss of time and waste of money. It is very seldom that a suitable telpher system cannot be designed, and once this has been installed loads may be picked up and carried speedily and safely from one department to another.

Passage through doors is often necessary in traffic of this kind, and this is provided for in the case of Morris electric telphers by a very ingenious device. The trolley-hoists are fitted with a curved buffer at each end. When one approaches a door its speed is reduced, but it does not stop. The buffer makes contact with rollers on the doors, which must be spring mounted. These open gently on the application of pressure and close quietly after the trolley-hoist has passed through.

To return to our cover, a little examination will show how perfectly the electric telpher satisfies the requirements. Branches from the main overhead rail are taken completely round the kilns in which the ore is roasted, in order that the skips may be brought to any one of the several discharging chutes, as required. The skips are lowered to the ground and filled with roasted ore. The trolley-hoist then raises them again and carries them with it, first across the junction on to the main overhead rail, and then on to the blast furnaces. In this manner the roasted ore is taken away in an endless stream of skips without any difficulty.





Electric telpher system for use in unloading barges. The trolley-hoist travels over the centre line of each vessel. For the illustrations to this article we are indebted to Herbert Morris Ltd., Loughborough

Below: Trolley-hoist with automatic grab for carrying coal

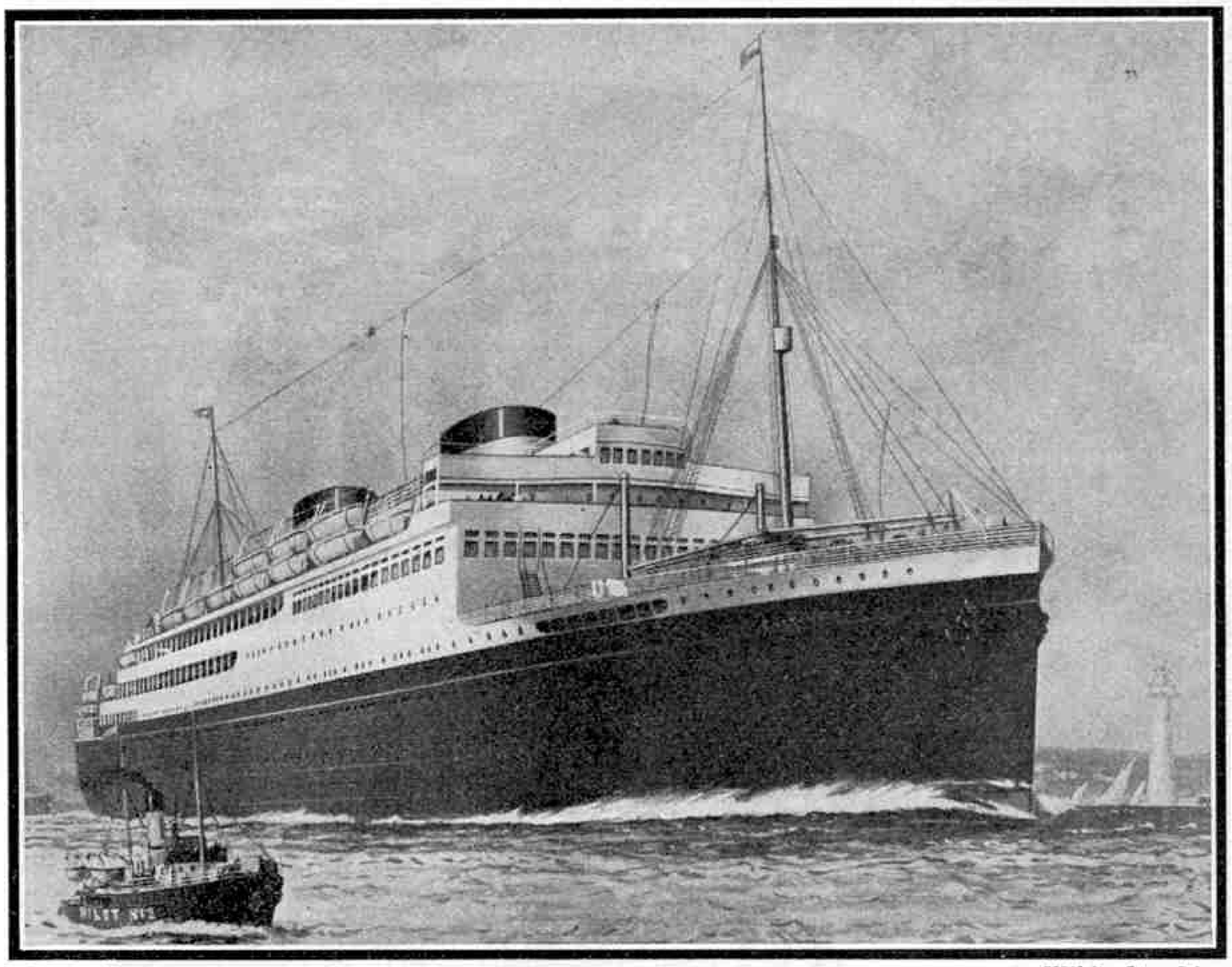
The advantages of being able to erect an electric telpher in almost any position are illustrated by the use of these overhead lines in unloading barges or ships. The rail may be made to overhang the wharf alongside which the barges are moored, and to run parallel with it.

An interesting example of the adaptability of the electric telpher is illustrated in the accompanying photograph, which shows trolley-hoists in use for unloading barrels from barges. It will be seen that the rails from the factory on the right end in a loop that extends over the water. The outer rail passes over the barges, and the entire cargo can be discharged without moving a single barrel nearer the hoist by hand. Thus all unnecessary handling is eliminated.

The New White Star Liner "*Britannic*"

Largest British Motor Vessel Afloat

THE most noteworthy event of the year in British shipping has been the launch of the twin screw motor passenger liner "*Britannic*," built at Belfast by Harland & Wolff Ltd. for the White Star Line. The "*Britannic*" is intended for the Liverpool-New York service and forms a notable addition to the White Star fleet, as she is the largest British motor ship. She has been built to meet the requirements of Lloyds and the Board of Trade and her principal dimensions are :— Length, between perpendiculars, 680 ft. ; breadth moulded, 82 ft. ; depth moulded, 43 ft. 9 in. ; gross tonnage, 26,840.



Courtesy] [*White Star Line*

The new White Star motor liner "*Britannic*," the largest British motor ship afloat

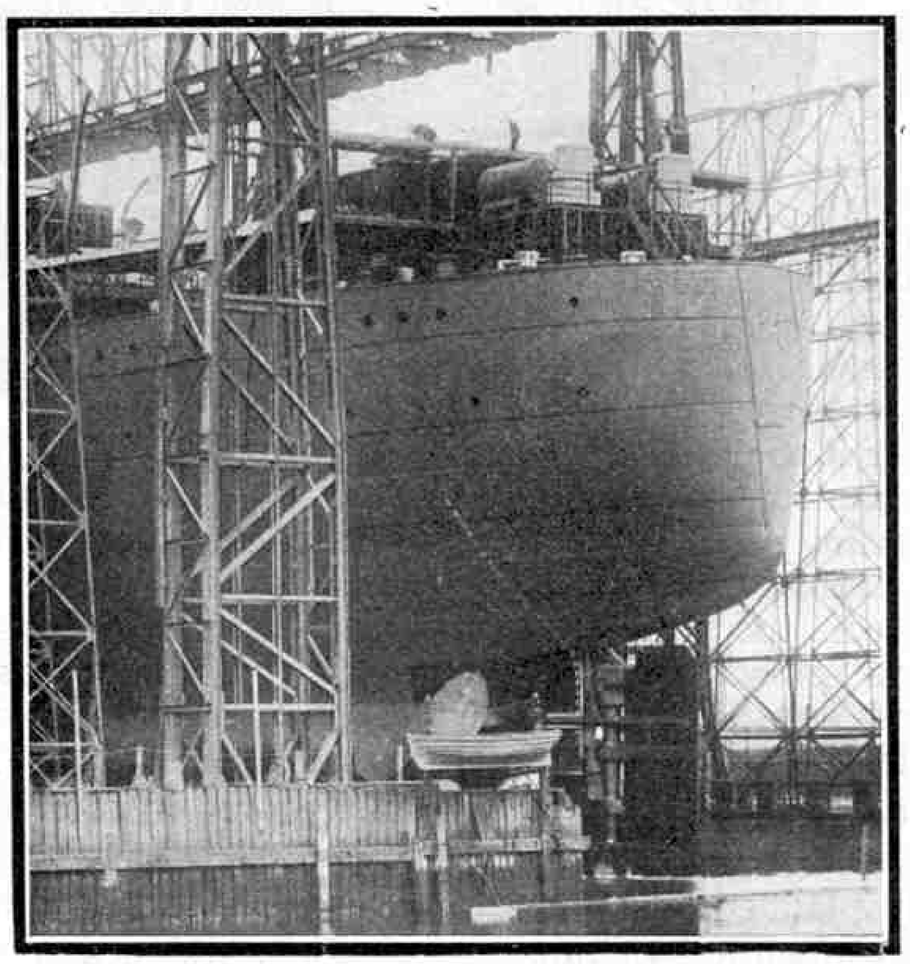
The vessel is modelled on the most modern lines, with a straight stem and cruiser stern, and is fitted with two funnels of the low type so characteristic of most of the recently-built large motor liners. Water-tight bulkheads subdivide the ship into 13 water-tight compartments, and extending the whole length of the vessel is a double bottom arranged to carry fresh water, water ballast and oil fuel.

The accommodation provided for the 1,550 passengers, cabin, tourist, and third-class, sets up a new standard on this route ; noteworthy features being a swimming pool and tennis courts in the cabin class, and elevators and children's playrooms in the tourist and third-class accommodation. The size of the ship has given ample opportunities for spacious planning and effortless design in the cabin class public rooms, and all impression of restricted space has been eliminated with complete success.

The dining saloon, in the Louis XIV style, is for the greater part two decks high. A feature is made of the lighting, which in the centre portion of the room is mainly concealed, flooding the whole of the upper part with a soft glow and adding to the apparent height.

The B deck entrance has been arranged so as to form the centre of the business side of passenger life, all the essential services being grouped together. Here are the offices of the purser, the chief steward, and the mail baggage master, and the enquiry and wireless offices, with an effectively arranged shop on modern lines near the lift. A fireplace and recesses for settees and chairs complete the scheme on this deck, which should prove a very satisfactory arrangement from the point of view of passengers making use of the vessel.

On the promenade deck are the principal public rooms. At the forward end is a picturesque card-room decorated in the French style of late Gothic, with moulded and carved panels, a quaint stone fireplace with heraldic decoration above, a stone-patterned floor, and carved furniture with rich coloured tapestry and leather upholstery. The lighting is by concealed lights. These are fixed in the cornice below a coved and oak-beamed ceiling.



Courtesy] [*Harland & Wolff Ltd.*

A stern view of the "*Britannic*" on the slips

The lounge is in the late eighteenth century English style, made interesting with modern pier glasses and varied furnishing. A large central dome in this room gives opportunity for installing a cinematograph and screen so that passengers may enjoy a varied selection of the latest films. Dancing will take place in this lounge.

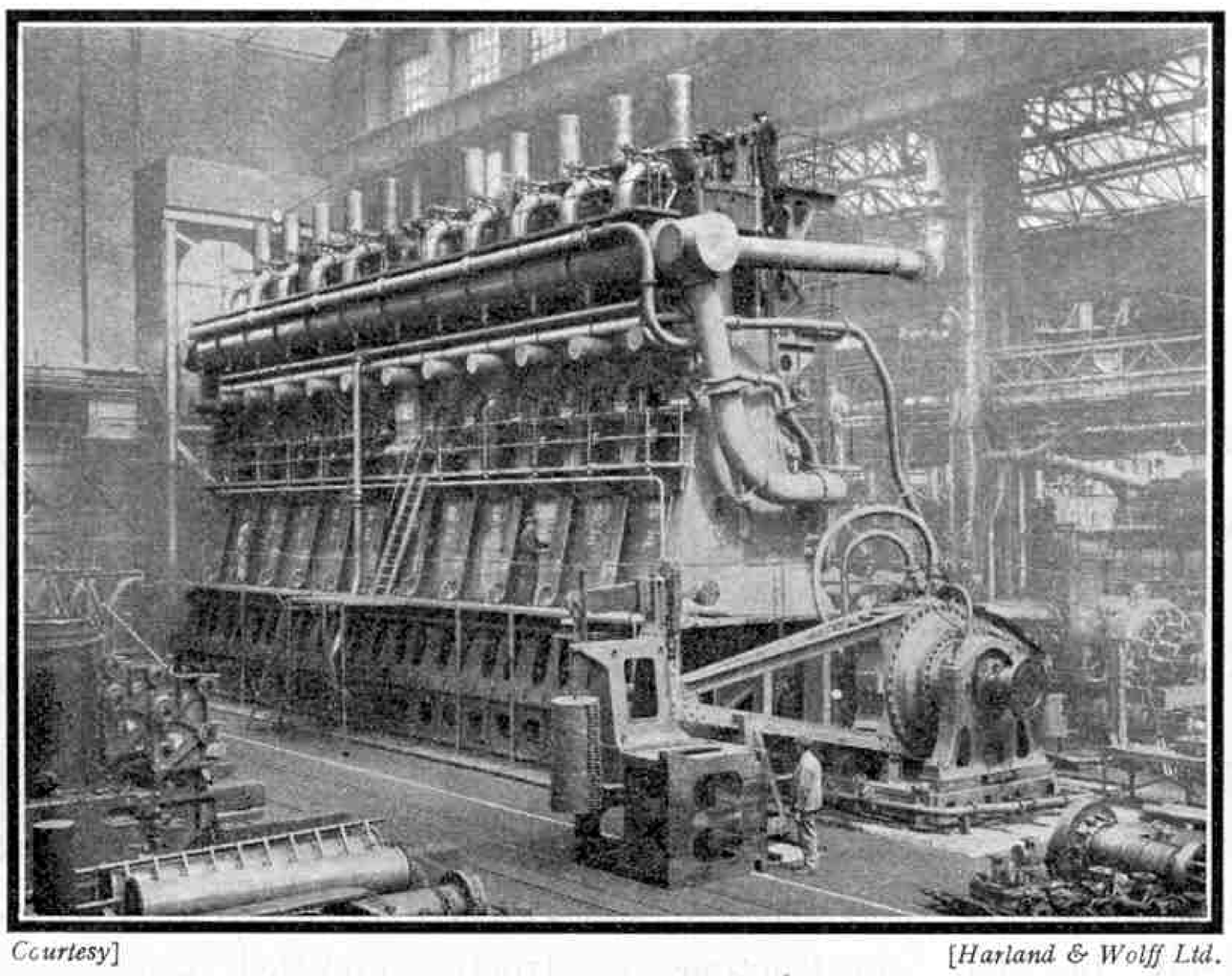
Leading from the lounge to the smoking-room is a long gallery

that will form a promenade particularly attractive to those who enjoy a morning constitutional. The after staircase opens from this gallery, and retired from the general public rooms is the drawing-room. An ingenious arrangement of folding screens allows this room to be used as a chapel.

The smoking-room is a reconstruction of a room in an Elizabethan mansion and the verandah café at the after end of the promenade deck is in Old English black and white work and is fitted with sliding doors, making it a pleasant resort in all kinds of weather.

A large swimming bath is provided, with ample space for spectators. The bathing pool is lit by powerful flood lights shining direct from the ceiling, while the ceiling in turn is lit by bowl fittings on the pillars. There is no direct lighting on the walls and thus all shadows are eliminated.

The alleyways to the passenger accommodation have been carefully designed in bays divided by pilasters and finished in a pleasant colour scheme in order to avoid the uninteresting effect that these long passages are so liable to produce.



Courtesy] [*Harland & Wolff Ltd.*

One of the "*Britannic's*" twin screw, 10-cylinder, 10,000 b.h.p. Diesel engines on the test bed

The tourist and third-class public rooms and entrances have been given special attention with the object of making them as comfortable and attractive as possible. With the exception of the smoking-rooms and play-rooms, the walls are panelled and coloured in various art shades to suit the position of the rooms. The ceilings also are panelled and the floors are covered with lino tiles in large designs. The smoking-rooms are panelled in oak with half-timbers characteristic of the early English style, and the walls of the children's play-rooms are decorated in appropriate style with pictures representing nursery rhymes and fairy tales.

Courtesy] [*White Star Line*

The cabin lounge of the "*Britannic*"

The vessel has an interesting electrical installation. The supply is taken from four Diesel-driven generators having a combined capacity of 2,000 k.w., situated in a separate compartment next to the main engine-room; and a 75 k.w. Diesel-driven emergency generator for supplying lighting and power for all essential services if for any reason the main sets should be out of action.

The cooking throughout is carried out electrically and the baker's and confectioner's ovens, which are of the most modern type, are also electrically operated.

Ventilation is provided by about 75 electrically-driven pressure fans, ranging in size from 10 in. to 55 in. in diameter. These fans include a number fitted with heating elements, by means of which the vessel can be kept comfortably warm in the coldest weather that is likely to be experienced. These air-heating fan units are supplemented by electric heaters distributed throughout the accommodation.

The deck machinery includes 16 electrically-driven winches, steering gear, four large capstans and two large warping winches. Each of the forward capstans is driven by a 170 h.p. motor; each of the after capstans by a 100 h.p. motor, and each of the warping winches by a 105 h.p. motor. In addition, there are service motors driving such apparatus as potato-peelers, dish-washers, elevators, silver-cleaning machines, etc. There are also two electrically-operated sounding machines and a very complete wireless installation.

An interesting feature is the call bell system. Instead of the usual bell indicator, two small electric lamps are installed outside each stateroom, one coloured red for steward, and the other green for stewardess. These lamps are operated by similarly coloured pushes in each stateroom, and they remain lit until the attending steward or stewardess operates a push that is fixed outside each stateroom door. Tell-tale lights are placed also in central positions throughout the ship, not only to indicate the deck on which the call has been made, but also to guide the attendant to the stateroom. It is anticipated that by this means a very efficient and silent service will be maintained. The extent of the lighting may be gathered from the fact that there is an equivalent of over seven thousand 30-watt lamps installed throughout the ship.

The propelling machinery consists of two 10-cylinder double-acting four-cycle motor engines of the Harland B & W type, each designed (*Continued on page 874*)

Pennsylvania Railroad Abolishes Wooden Passenger Coaches

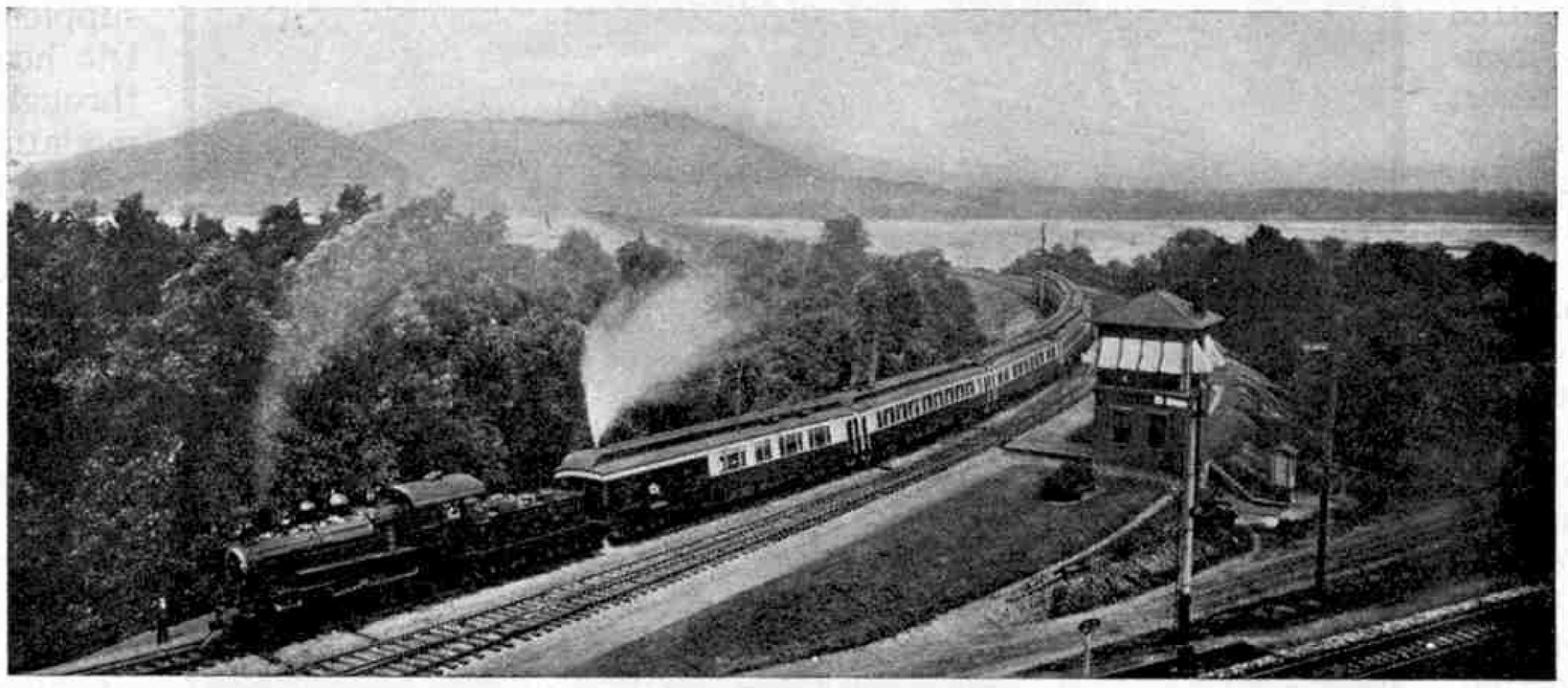
Huge Order for All-Steel Vehicles

THE latest landmark in the progress of the Pennsylvania Railroad, U.S.A., is the retirement of the last wooden passenger coach from regular steam service. All passenger coaches now in normal operation on the company's steam lines are exclusively of steel construction throughout—an enormous gain in safety and comfort.

This complete change has been made possible by a number of enormous orders placed last year with coach and equipment manufacturers. These orders included 300 standard all-steel 70 ft. passenger coaches; 210 standard all-steel 60 ft. baggage cars; 20 standard all-steel 70 ft. combined passenger and baggage coaches; 45 all-steel theatrical scenery vans, and 29 all-steel petrol-electric rail motor cars. In addition to these were 25 all-steel express horse trucks for the transportation of valuable horses by express service in passenger trains. These new horse trucks are very efficient and are named after various famous race tracks of the United States.

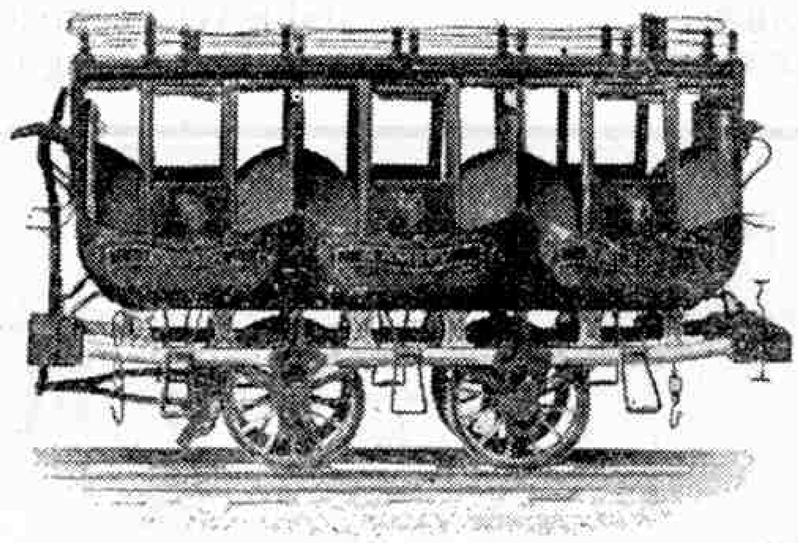
The total of these orders was for 629 new vehicles, representing an expenditure of approximately 15 million dollars (£3,000,000).

Twenty-three years ago the Pennsylvania Railroad built and placed in service the first all-steel passenger coach to be constructed and operated by any railway. In the same year the steel car was made a standard for the system, and the construction of wooden cars was discontinued. In 1914, at the outbreak of the Great War, the company had built steel cars so rapidly that more than one-third of their passenger equipment was of all-steel construction, and their development has been continued.



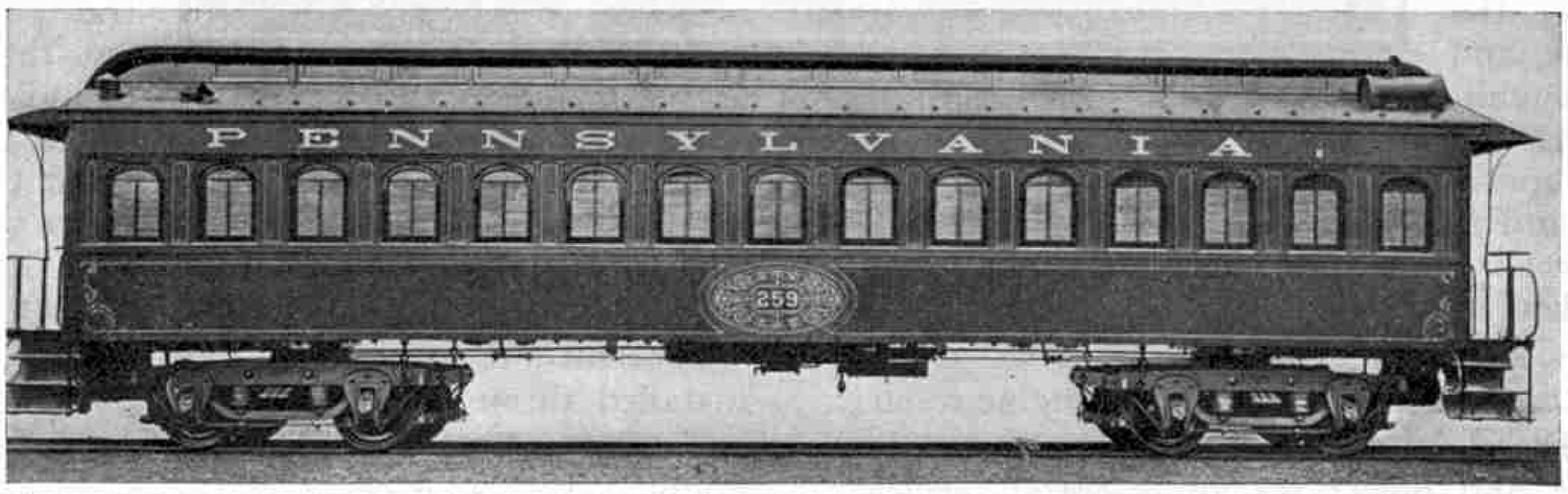
The "Pennsylvania Limited," running between New York and Chicago, as it appeared in 1898. This was the first train in the world to be lighted by electricity. For the photographs illustrating this article we are indebted to the Pennsylvania Railroad

The Pennsylvania Railroad now own practically one-fifth of all the steel cars in the country, and although their lines are but one-twentieth of the nation's total railway mileage, they handle 18 per cent. of the entire passenger traffic.



One of the earliest passenger coaches used in America. This was little more than an ordinary stage coach equipped with flanged wheels

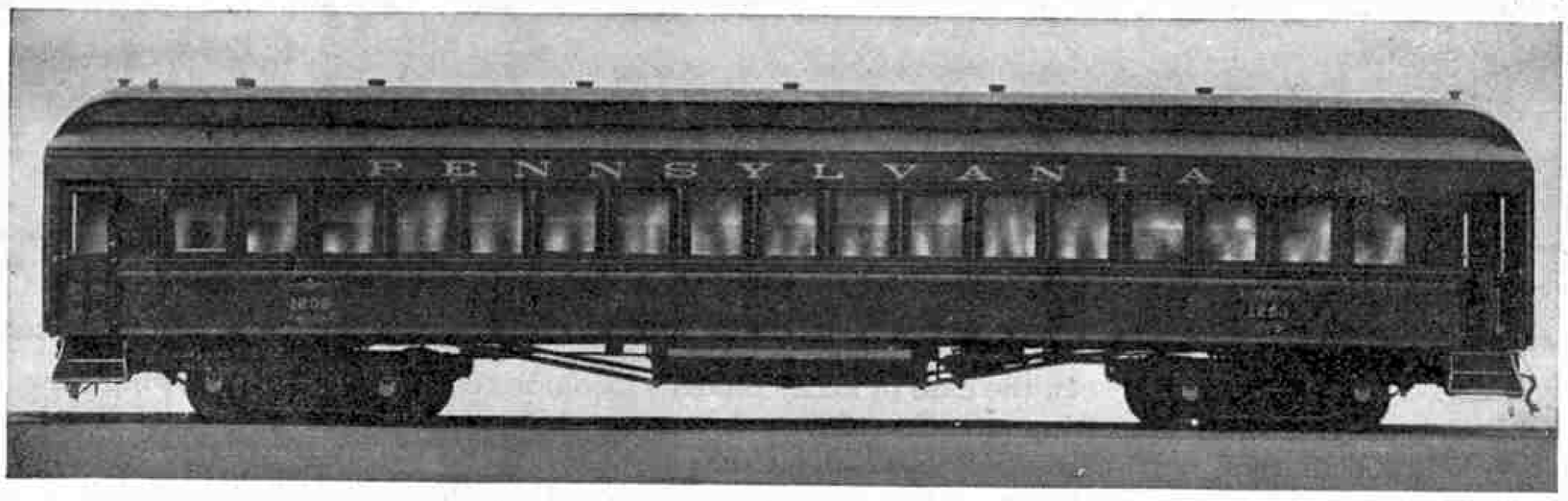
As far back as 1902 the company began to study the possibility of building stronger, safer, and more comfortable passenger coaches than the wooden vehicles then in general use. Trains were becoming longer and heavier, and there was need for greater strength and more durability in construction to withstand the wear and tear of daily service. The introduction of the steel underframe met the requirements to some extent, but the wooden coach body still remained a problem from the standpoint of safety and prevention of fire. The development of an entirely new type of coach of steel construction received impetus from the plans then taking definite form with the company's great terminal project in New York City. These plans involved the construction of tunnels under the Hudson River as a means of providing access to the proposed new station in the heart of



The standard Pennsylvania Railroad all-wood coach of 1875, which had gas lamps and a wood stove. It was 53 ft. in length, and seated 54 people

Manhatton. The undesirability of operating wooden cars from such tunnels was obvious, and it supplied an additional incentive for working out the design of an entirely new type of car that should be free from the numerous defects that were present in the old form of wooden coach construction then in vogue.

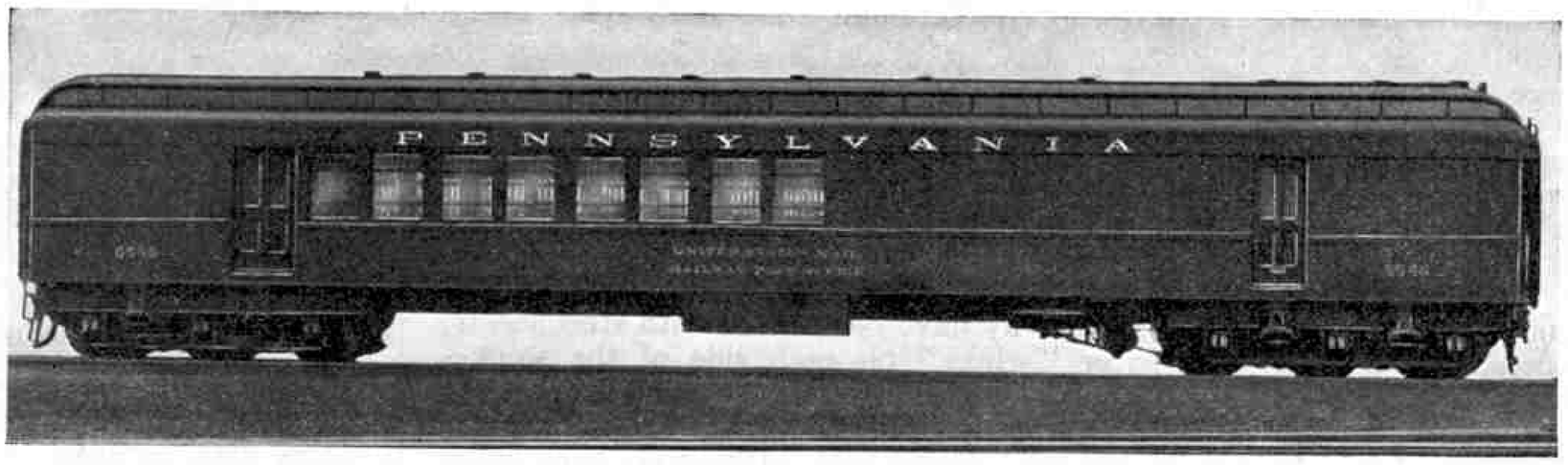
All these influences worked together with the result that in 1904 the various studies that had been made took the form of definite plans, and in June 1906 the first steel passenger coach was turned out of the company's Altoona Works. This car was 67½ ft. in length overall, and was about 5 ft. longer than the standard wooden coach. It had a steel underframe with steel sheathing up to the roof. The inside finish was largely composite board, while the roof was of wood covered with canvas and copper.



The perfected wooden coach of 1898. This was the Pennsylvania Railroad standard passenger coach just before the introduction of all-steel equipment. It was 62 ft. in length, and seated 66 people

This new steel coach, while marking a distinct improvement upon the wooden type, did not satisfy the railway management. Another attempt was made, and this time a 70 ft. coach was constructed. In this, wood was practically eliminated, finding a place only in minor interior fittings such as the seat, arms, window frame and sills. This coach was completed in 1907, and since it was placed in service only all-steel coaches have been built by the company. Immediately following on the heels of this coach came a steel baggage van and three steel postal vans. Orders were then placed for 200 all-steel vehicles of various kinds, and these were put in service in 1908. Since that time the company have been steadily withdrawing their wooden coaches, and in 1927 alone a total of 559 of these coaches were taken out of service.

A standard all-steel combination passenger-baggage coach which is electric lighted and steam heated. It is 77 ft. 3 in. in length, and accommodates 44 passengers, in addition to a baggage capacity of 35,000 lb.



The Pennsylvania standard mail coach. This is 74 ft. 4 in. in length, has a mail carrying capacity of 30,000 lb. and weighs 125,000 lb. It is devoted entirely to the handling of United States mail, and comprises a complete travelling post office

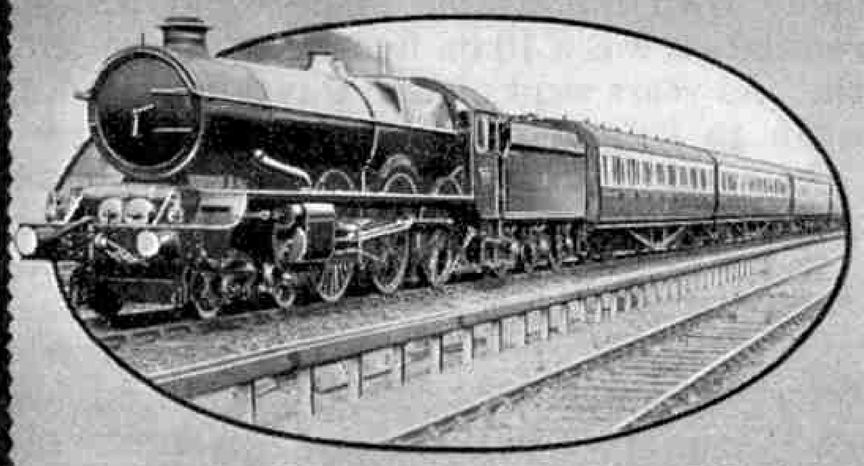
The story of the evolution of the railway passenger coach in America is full of romance and interest. First came the stage coach fitted with flanged wheels for rail operation, and imported in its entirety from England. Then appeared another type, just a box on wheels with a diminutive platform at each end. It was lighted by four small windows with immovable sashes, and the only source of ventilation was a 10 in. flue placed in the centre of the coach. As years went on and travel increased, the coaches began to lengthen and the windows grew in number. The seats, at first hard and uninviting, were comfortably padded and cushioned, and in cold weather the passengers, instead of freezing, enjoyed the warmth of a wood stove placed in one corner. The candle or tallow dip was replaced by oil lamps, and these in turn by gas lamps. At the same time improved springing was introduced and the ventilation was very greatly improved, including windows that could be opened or closed at will.

The Pennsylvania Railroad Company have always been keen to adopt the latest safeguards and conveniences for passenger travel. They were the first railroad to adopt the air brake, a device that revolutionised railway travel and established new standards of safety and efficiency in train operation. They were also one of the first companies to discontinue the construction of cars with open platforms, substituting the enclosed vestibule that is used in its perfected form in the modern all-steel passenger coach.

The first train in the world to be fully equipped with electric light was the "*Pennsylvania Limited.*" This New York-Philadelphia-Chicago flyer made its first trip with the new illumination in June, 1887. Electricity was used to light Pennsylvania railroad coaches long before its introduction generally in American homes.

The company's coaches are unique in being ventilated and heated on the same scientifically designed system that is approved for use in theatres, schools and other public buildings. The movement of the train draws fresh air into the coach through receptacles on the roof. The air is then carried to ducts beneath the seats, where it is passed over heat coils and thence into the coach proper, so that in winter the

(*Continued on page 874*)



THE DOWN CHELTENHAM EXPRESS

RAILWAY NEWS

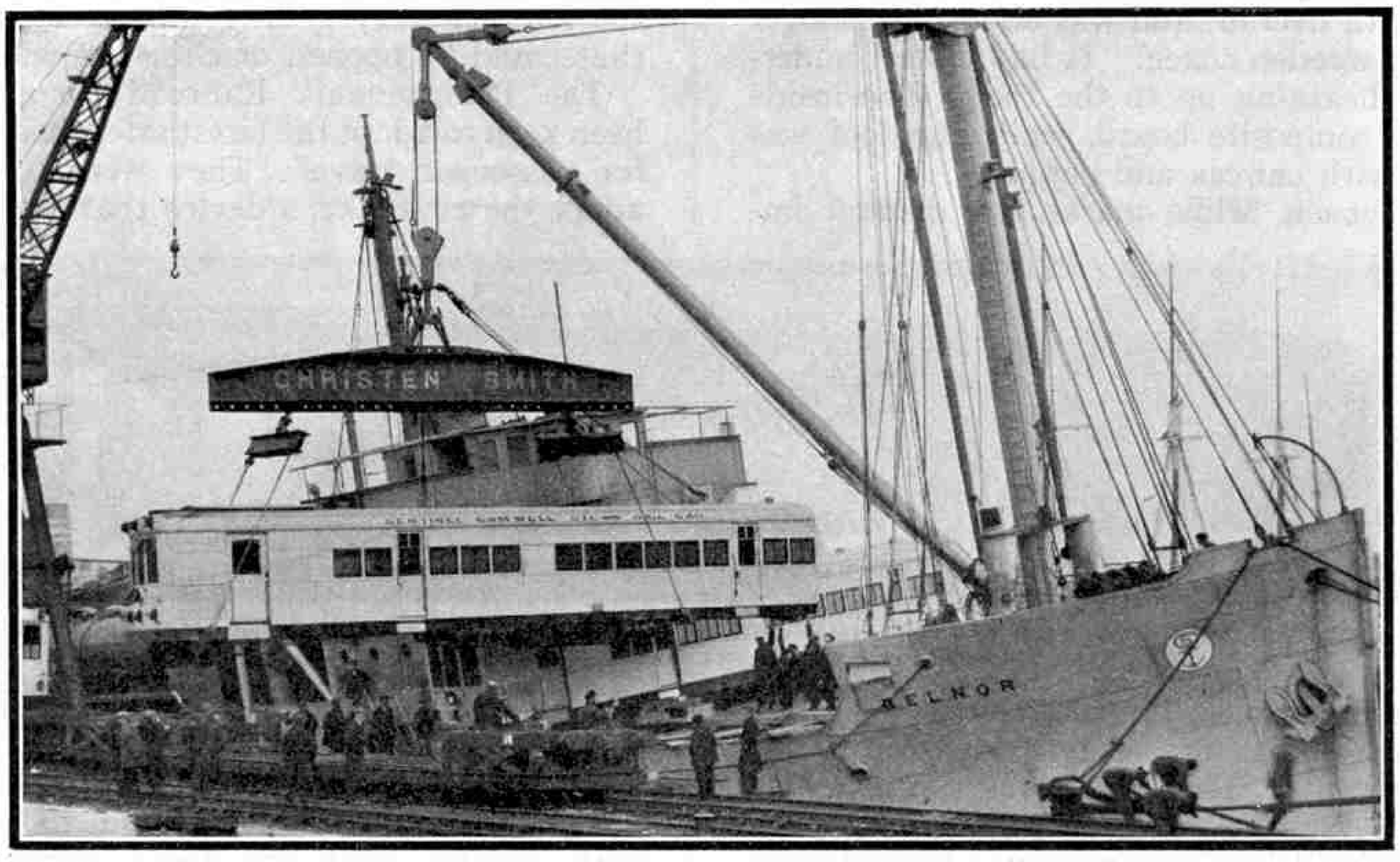
Ship's Cargo of Locomotives

An interesting cargo was loaded recently at Middlesbrough in the m.v. "*Belnor.*" This comprised four complete locomotives, with passenger coaches and barges.

The locomotives are of the "Mikado" type complete with tenders. Each weighs about 80 tons and they are to be discharged at Smyrna. They travelled on their own wheels from the works of the makers, R. Stephenson Ltd., Darlington, to the wharf at which the vessel was berthed.

The passenger coaches are Sentinel-Cammell Steel Rail Coaches, constructed by Cammell Laird & Co. Ltd., and are for discharge in India. There are three coaches, each with trailing car, and they were conveyed from Nottingham on high capacity railway wagons. The barges were built on the Tyne, being towed from there to Middlesbrough, where they were brought alongside the "*Belnor*" in dock, and are for discharge at Constantinople.

The motor vessel "*Belnor*" is one of a fleet of vessels of special design built by Armstrong Whitworth & Co. Ltd., Newcastle-on-Tyne, for the conveyance of exceptional cargoes of this description. Two similar vessels, the "*Beldis*" and the "*Belray*" have previously been constructed, and have been loaded at Middlesbrough with cargoes of this type.



Courtesy] [*L.N.E.R.*

A Sentinel-Cammell Steel Rail Car being hoisted on board M.V. "*Belnor.*" This vessel has been specially designed for the conveyance of locomotives and rolling stock. The locomotive that may be seen behind the steam rail car is of the "Mikado" type, and is one of four built for the Ottoman State Railways

Metropolitan Railway Speed-up

With the introduction of new timetables on 1st October, the Metropolitan Railway made many improvements on the previous service. There are now more trains during the busy hours of the day; more fast trains to and from the outer suburbs; trains of greater length; others retimed to suit the convenience of the travelling public, and also a speeding-up of the service generally. The daily traffic through Baker Street has been increased to 1,437 trains.

Smoke Deflectors for Locomotives

In the case of many modern locomotives, owing to the short chimneys that are necessarily used and to the softness of the exhaust when running at speed with short cut-offs, there is a tendency for the steam and smoke to drift down on to the windows of the cab and obscure the look-out of the driver and fireman. In the attempt to cure this trouble several devices are now being employed, the object of which is to create an upward current of air that will lift the exhaust from the chimney clear of the cab windows.

The "King Arthurs" of the Southern Railway have been fitted with steel sheets, or "wings," on each side of the smoke-box. "*Lord Nelson*" has been similarly equipped. On the L.M.S. several engines of the "Royal Scot" type have been fitted with devices of varying design on the top of the smoke-box and around the chimney. These attachments do not improve the appearance of the engines, but it is hoped that they will be effectual in curing the evil of "drifting."

There are also many locomotives on the Continent fitted with these "wings." There the practice has become more common of recent years, especially so in Germany, where it is said to have originated.

G.W.R. Locomotive News

The following new passenger engines of the 4–6–0 (Hall) class have been turned out of the Swindon works:—No. 4945, "*Milligan Hall.*" No. 4946, "*Moseley Hall.*" No. 4947, "*Nanhoran Hall.*" No. 4948, "*Northwick Hall.*" No. 4949, "*Packwood Hall.*" No. 4950, "*Patshull Hall.*" No. 4954, "*Plaish Hall.*" No. 4955, "*Plaspower Hall.*"

Since the winter working came into force the "*Cornish Riviera Express*" has frequently loaded up to 15 coaches. On one morning in October it left Paddington with no less than 16, including a heavily-laden bogie van of bullion next to the engine. The total load behind the tender was little short of 600 tons.

Two new trains have been provided for the "*Torbay Limited Express.*" The new coaches are of similar design to those recently built for the "*Cornish Riviera Express,*" but broad bands of gold and bolder lettering, also in gold, give them a more handsome appearance.

Twenty-thousand schoolboys, including a large proportion of "Meccano" and "Hornby" enthusiasts, have visited Swindon Works since the beginning of the present year.

L.M.S. Locomotive News

Fifty of the new 0–8–0 standard freight engines are now in service, their numbers being 9500 to 9549. Of the later engines, 9529-40 have been allocated to the Midland division. The latest 2–6–4 passenger tank engines turned out from Derby carry numbers 2360-4. Ten more engines of the same type will be ready shortly and will be employed on the Midland division.

No. 5403, "*Leamington Spa,*" a "George the Fifth" engine, and Nos. 8719 and 8752 mixed traffic 4–6–0's, have been adapted for use over the Midland division.

New L.M.S. Freight Engines

One hundred 0–8–0 freight tender engines are being built at Crewe to the designs of Sir Henry Fowler. The first engine was handed over to traffic on March 30th, 1929, and the remainder will be completed this year.

These engines have been designed to give a tractive effort of 28,250 lb. (at 85 per cent. of the boiler pressure), and are similar in power to the existing G2 class 8-coupled coal engines originally built at Crewe for the L. & N.W. Railway, but with the following alterations :—

Original G2 Engine—Inside cylinders, 20½ in. by 24 in.; Joy valve gear with short travel; wheels, 4 ft. 5½ in.

New Standard 0–8–0 Engines—Inside cylinders, 19 in. by 26 in.; Walschaert's gear with a long valve travel; wheels, 4 ft. 8½ in.

The original boiler fitted on the G2 class engine has been retained, but the pressure has been increased from 180 to 200 lb. per square inch, and the size of cylinders reduced, whilst the wheels are slightly larger in diameter.

An exhaust steam injector is provided on the right-hand side of the engine. Mechanical lubrication is fitted for the cylinders, piston valves and spindles and piston rods, and a second mechanical lubricator supplies oil to the coupled axleboxes.

Where possible, standard locomotive and boiler fittings have been provided to facilitate interchangeability. The cab is well ventilated and gives easy control of all fittings. As these engines are required for working coal traffic, steam brake only is provided, with special valve for graduating brake-pressure as required.

The engine is coupled to a standard 3,500 gallon tender with 4-ton coal-carrying capacity.

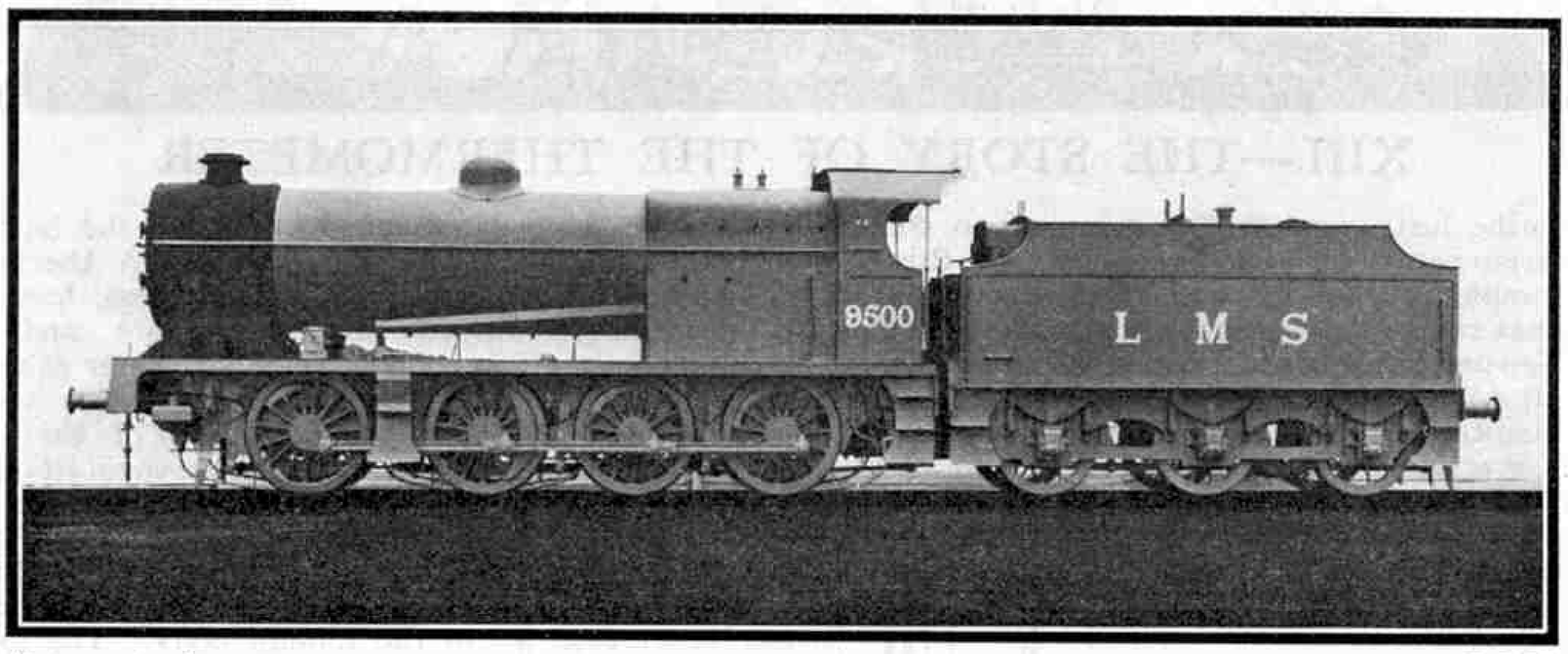


Photo courtesy] [*L.M.S.*

The New L.M.S. 0–8–0 Standard Freight Locomotive

Compliment to British Railways

British railways have been paid another compliment by an American railway. The New York Central Railroad Company have adopted the chocolate and cream colour scheme of the Great Western Railway on two new sets of coaches built for use on its *de luxe* day trains between Detroit and Cincinnati.

Last of Trolley Trains

The whole of the Southern Railway's suburban electrified system has now been converted from overhead to the third-rail principle. This change involves the disappearance of the "alternating" system of electrification, which was begun by the old London, Brighton and South Coast Company 20 years ago.

The third-rail principle was used successfully on the London and South Western Railway and to render through running possible, this system has now been standardised.

L.N.E.R. Locomotive News

Additional engines of the J39 class, 0–6–0 goods, are being built at Darlington. They are to have the vacuum brake only.

One of the new "Sentinel" six-cylinder steam rail cars, No. 51912, *"Rising Sun,"* is to work on the Finchley-Edgware branch.

A second of the Gresley "Pacifics," No. 2576, *"The White Knight,"* has been fitted with feed-water heating apparatus.

The L.N.E.R. report some excellent performances on the part of the "Pacifics." No. 4476, *"Royal Lancer,"* has covered no less than 385,903 miles in the 325 weeks of its existence, averaging nearly 1,200 miles a week, including time spent in overhauls. No. 2569, *"Gladiateur,"* has maintained a daily average of 362 miles for 74 consecutive days, or a total of 26,800 miles, without needing any repairs.

Southern Railway Notes

The five additional engines of the "Lord Nelson" class that were included in the programme of new engines to be built at Eastleigh during 1929, will soon be completed. The first of the batch, No. E861, *"Lord Anson,"* is already in service.

During the winter months the normal loading of the *"Atlantic Coast Express,"* 11 a.m. from Waterloo, is nine coaches, and *each coach has a different destination!* This must be unique in railway working. The first coach is for Ilfracome; the second for Torrington; the third for Plymouth; the fourth for Padstow; the fifth for Bude; the sixth—a dining saloon—for Exeter; the seventh for Budleigh Salterton and Exmouth; the eighth for Sidmouth; and the ninth for Seaton. Of course, additional coaches are used when the traffic requires them.

Two hundred coaches of a new type are to be constructed. A special feature of these vehicles is that the height of the corridor windows is increased, thereby giving more satisfactory lighting.

L.M.S. and L.N.E.R. New Railway

The building of a new railway in England is rather an event in the year 1929. Work has now been started on a railway that is to be called the Mid-Nottinghamshire Joint Railways, and is being constructed by the L.M.S.R. and the L.N.E.R. The line, which is to be nearly eight miles in length, breaks off from the L.M.S. Mansfield and Southwell line near Farnsfield, the terminus of the line being at Ollerton. When completed it will form a new outlet from collieries in the Mid-Nottinghamshire district.

The carrying out of the work will involve the excavation of some 922,000 cubic yards of cutting, together with the construction of 24 bridges and a viaduct. Nearly 1,000 tons of steel will be used for girders, bedplates and bolts, and the line will be enclosed by 18¾ miles of fencing.

The new railway will be controlled by a joint committee of directors appointed by the two railways concerned, under the title of the Mid-Nottinghamshire Joint Railways Committee.

L.M.S. Developments

The last Budget as passed by Parliament provided for the abolition of the Railway Passenger Duty on condition that the railways devoted the money thus gained to schemes for development and modernisation. The L.M.S. have decided on a programme that will cost £2,250,000, and includes :—

£300,000 for 30 Garratt locomotives, each of which will do the work of two ordinary engines.

£150,000 for 25 other locomotives.

£200,000 for the strengthening of bridges.

£200,000 for the conversion of gas-lit carriages to electric lighting.

£450,000 for improving goods terminal accommodation at Camden Town, Birmingham, and Stoke-on-Trent, and increasing the capacity of coal-shipping plant at Garston (near Liverpool), Grangemouth, Ayr, Troon, and Swansea.

£140,000 for additional running line facilities, thus obviating delay to fast passenger traffic caused by goods shunting operations.

£110,000 for additional traffic sheds and siding accommodation at Goole Docks.

£63,000 for improvements to the passenger accommodation at various stations.

Steel Sleepers on the L.M.S.

By way of experiment, steel sleepers are to be laid at selected places on the L.M.S. main line between Euston and Carlisle. A section where they have been already laid is in the neighbourhood of South Hampstead between Euston and Kilburn.

DIFFICULTIES EXPLAINED

XIV—Lettering on the Underframes of Coaches

We have frequently had letters from readers enquiring as to the significance of various markings on the underframes of coaches, the most common of which are "S," "V" or "W." These are painted on for the guidance of shunters, carriage examiners and others. "S" indicates the steam heating apparatus; "V" is seen on vacuum brake fitted vehicles, and "W" refers to those having the Westinghouse system.

The letters indicate the positions of small chains whereby the vacuum or Westinghouse brakes, as the case may be, may be released and the vehicles moved in the absence of an engine, as is sometimes necessary.

XIII.—THE STORY OF THE THERMOMETER

THERE is no scientific instrument so familiar and so widely used as the thermometer. The ordinary type of this instrument is so simple and nowadays so easily made that it is difficult to realise that some of the greatest scientists, including Galileo and Sir Isaac Newton, have played a part in its development.

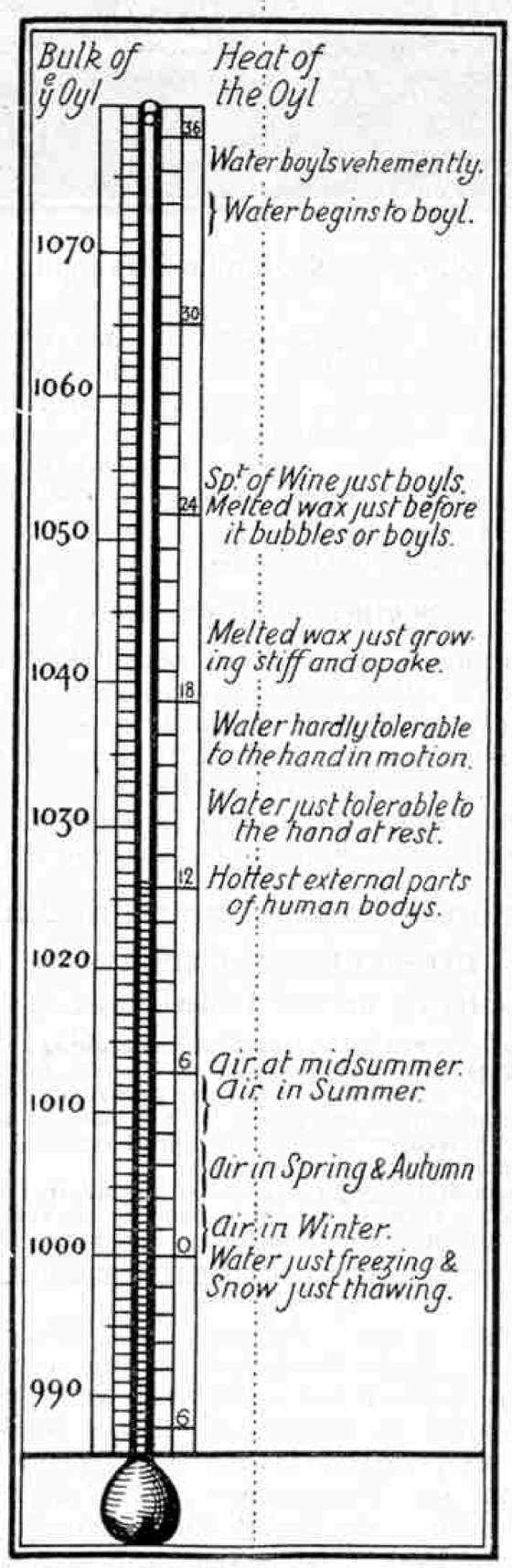
It is always difficult to trace the origin of inventions that take a long time to come to maturity because the initial discovery seems so unimportant at the time it is made that it is either not placed on record or, if recorded, attracts little attention and is soon forgotten. This is the case with the thermometer, and some uncertainty exists as to when and by whom it was invented. There appears to be no doubt, however, that the first thermometer was made in Italy somewhere about the end of the sixteenth century, the invention being variously ascribed to Sanctorius of Padua in 1590, and to Galileo in 1602.

In his book *"Galileo: Life and Works,"* Mr. J. J. Fahie gives the following interesting quotation from a letter dated 20th September, 1638, written to a fellow countryman by Father Castelli, a lifelong friend of Galileo:—"'I remember the experiment which our Signor Galileo had shown me more than 35 years ago. He took a small glass bottle, about the size of a hen's egg, the neck of which was two palms long (about twenty-two inches), and as narrow as a straw. Having well heated the bulb in his hand, he inserted its mouth in a vessel containing a little water, and, withdrawing the heat of his hand from the bulb, instantly the water rose in the neck more than a palm above its level in the vessel. It is thus that he constructed an instrument for measuring the degrees of heat and cold.'

"From this it is plain that the instrument consisted merely of a glass tube ending in a bulb, the air in which, being partially expelled by heat, was replaced by water from a glass vessel in which the open end of the tube was plunged. The different degrees of temperature would then be indicated by the expansion or contraction of the air which remained in the bulb; so that the scale would be the reverse of that of the thermometer now in use, for the water would stand at the highest level in the coldest weather.

"So long as the orifice of the tube remained open, this instrument could not be an efficient measurer of temperature, for it was impossible to distinguish the expansive and contractive effects of heat and cold from the effects of varying atmospheric pressure. It was, in truth, a barometer as well as a thermometer, although Galileo apparently did not recognise its utility as such."

One of Galileo's thermometers is being exhibited at the present time at the National Exhibition of the History of Science at Florence. As is the case with all the earliest thermometers, it works on the principle that air expands on heating. It consists of a glass bulb blown on one end of a tube, the other end of which is bent and widened out to form an open reservoir. A coloured liquid occupies the greater part of the stem and extends into the reservoir. When the bulb is heated the column of liquid is forced down by the expansion of the enclosed air. The position of the top of the column as read on the scale behind gives a clue to the temperature of the bulb as the hotter this becomes the further the column will descend. A thermometer of this kind has a very limited range of usefulness, however, as it is affected by changes in atmospheric pressure, and as Father Castelli's letter notes, it is, in a sense, a barometer as well as a thermometer.



Reproduction of a rare drawing of Newton's thermometer, taken from a book written by one of his pupils and published in 1738. Note the quaint spelling then in vogue

These instruments were used to compare the heating conditions of the room and cellars of houses by carrying them from one place to another, any change in atmospheric pressure during the observations being too small to affect the readings.

Galileo also used his thermometer, with certain necessary precautions, to test the temperature of the human body. The high temperature of a person in the state of fever can be detected by the hand, but Galileo and his contemporaries recognised that an instrument, which could not suffer from imagination, would give a more certain indication. Thus in its earliest days the thermometer acquired a medical connection. This has since proved to be of the utmost value, and nowadays a doctor and his thermometer are inseparable.

The first real improvement in the air thermometer dates from about the middle of the 17th century when, under the direction of the Academia del Cimento in Florence, thermometers were constructed in which the bulb and a portion of the stem were filled with a liquid, either oil or spirits of wine (alcohol). The expansion of liquids generally is much less than that of air for the same rise in temperature, but by using tubes of narrow bore the expansion of the liquid can easily be observed. After warming the liquid until the column had reached the top of the tube and expelled all the air, the tube was sealed so as to prevent the escape of liquid and the entrance of dirt. The tube was divided into equal parts by dots of enamel placed on it.

Thermometers so constructed were readily carried about and, as they were independent of atmospheric pressure, they were far more useful than the air thermometers. This new type of instrument was largely employed by doctors for taking the temperatures of their patients. Many of those who owned such thermometers made special marks on them to indicate seasonal temperatures, such as the hottest and coldest days in certain years.

Some of the early instruments are still in existence. One originally in the possession of the Grand Duke of Tuscany may now be seen in the Cavendish Museum at Cambridge. Two years ago the present writer noticed one, probably of a little later date than the Cambridge specimen, in a remote Swiss hotel, and no doubt careful search would reveal others. Although these thermometers resemble modern instruments in the fact that they were based on the expansion of liquid when heated, they suffered from the serious difficulty that their readings did not afford any basis for comparison. The divisions were merely lengths on the stem, and they did not take into account either the size of the bulb or the diameter of the ball of the stem. Each was an independent instrument and in consequence was a law unto itself.

The method of marking every thermometer by means of fixed

standards, so that the instruments would agree with each other, was first put forward by Sir Isaac Newton in 1701. It had been observed by Doctor Hook twenty years previously that, if one of the thermometers then in use were placed in melting ice, the column of liquid always fell in exactly the same place; and Newton made use of this fact. The liquid he used was linseed oil, which boils at a much higher temperature than water, while on the other hand the boiling point of alcohol is lower.

The bulb was immersed in melting ice and the level to which the column fell was marked 0 degree or zero on the scale. Then the bulb was placed under the tongue or in the armpit of a healthy human being in order to acquire the temperature of the body, and the level to which the oil rose was marked 12 degrees. The space between these two marks was divided into twelve equal parts, each being one "degree of heat;" and the marking extended to the rest of the scale both upward and downward, each degree being the same length. Apparently the number 12 was chosen on account of the custom prevailing at that time of working in duodecimals, just as we now use ordinary decimals and make 10 the standard figure. When a thermometer divided in this manner was placed in boiling water the degree register was about 34, varying slightly with changes in atmospheric pressure, which alter the boiling point of water.

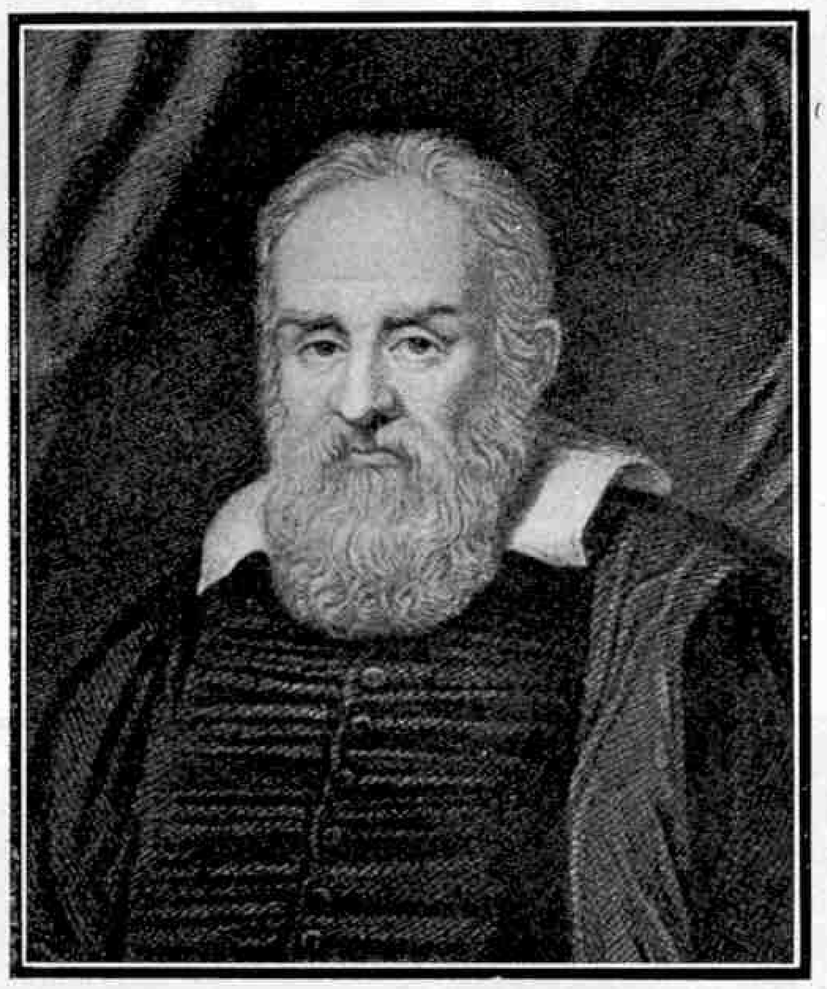
Newton made a number of interesting observations with his thermometer and tells us that 17 degrees is "the greatest heat of a bath that a person can bear while his hand is immersed and kept continually at rest for some time." He also estimated in a very ingenious manner that "the heat of burning coals in a small fire, not blown up with bellows," was 192 degrees on his scale although it could not be measured directly.

We are able to reproduce a rare drawing of Newton's thermometer taken from a book written by his pupil Roger Cotes and published in 1738. We are indebted for this illustration to Professor C. R. Darling, of the Royal Military Academy, Woolwich. The observations on the right-hand side of the stem are very interesting and remind one of the earlier Italian thermometers. The figures on the left of the stem relate to the volume of the linseed oil, which is called 1,000 at 0 degrees.

The great value of Newton's method of marking was that all thermometers made in this manner were interchangeable and would all read alike under the same conditions. Simple as it now seems to us, this was an immense advance, and it laid the foundation of the accurate measurement of temperatures. Indeed, we may say that the thermometer, so far as the principle of construction was concerned, was now fully developed. Any changes that have been made subsequently have been merely in the use of liquids or standards, the production of better bulbs and stems, and in more careful graduation.

The next step in the improvement of the thermometer was the introduction of mercury as the expanding liquid. Halley, the English Astronomer Royal, is said to have been the first to suggest the use of this metal, but the first mercury thermometer was constructed in 1709 by Romer, a Danish astronomer. The advantages of mercury over other liquids for this purpose are numerous. It has a high boiling point and a low freezing point, so that it may be used over a very large range of temperatures; it does not cling to glass; it is a good conductor of heat and attains the temperature of its surroundings more quickly than other liquids and—as has since been proved—it expands more uniformly.

Romer's first mercury thermometer appears to have been rather crudely made, and it was not until Gabriel Daniel Fahrenheit of Amsterdam took up their manufacture in 1714 that the superiority of mercury instruments was established. Fahrenheit improved the construction by making the bulbs cylindrical instead of spherical so that the heat could penetrate more quickly to the interior of the mercury; and he introduced a generally higher technique in the manufacture of the instruments.



Galileo Galilei, the famous Italian astronomer and inventor

Fahrenheit departed from Newton's method of dividing the stem, however, and substituted a plan of his own. He placed the bulb in a mixture of ice and salt in definite proportions, thus producing a temperature lower than that of melting ice and approximating to the lowest winter temperatures occuring in Europe. The position to which the mercury sank in this mixture was called 0 degrees or zero. He followed Newton's method of obtaining his second point from the human body, and he first called this 24 degrees, but afterwards 96 degrees. In melting ice a thermometer made in this manner registered 32 degrees and in boiling water 212 degrees, and thus the Fahrenheit scale was established.

Soon afterward Fahrenheit found it more convenient and accurate to use melting ice and boiling water for fixing his points, but he retained his figures of 32 degrees for the former and 212 degrees for the latter. Since that time melting ice and steam from boiling water have been universally employed for fixing the two points, and on a thermometer marked according to these standards the temperature of the human body is 98.4 degrees, and not 96 degrees.

There has been much discussion as to why Fahrenheit chose 96 degrees as the figure for his upper fixed point. The most probable explanation is that he was working in terms of 12 and chose 96 (8×12) divisions in order that the scale would be more finely divided and accurate reading made more easy. The choice of the zero point was probably made to enable winter temperatures to be recorded without using a minus sign or having to specify "above" or "below" zero.

The Fahrenheit scale has been retained in the British Empire and in the United States of America for general purposes, and it would now be difficult to displace.

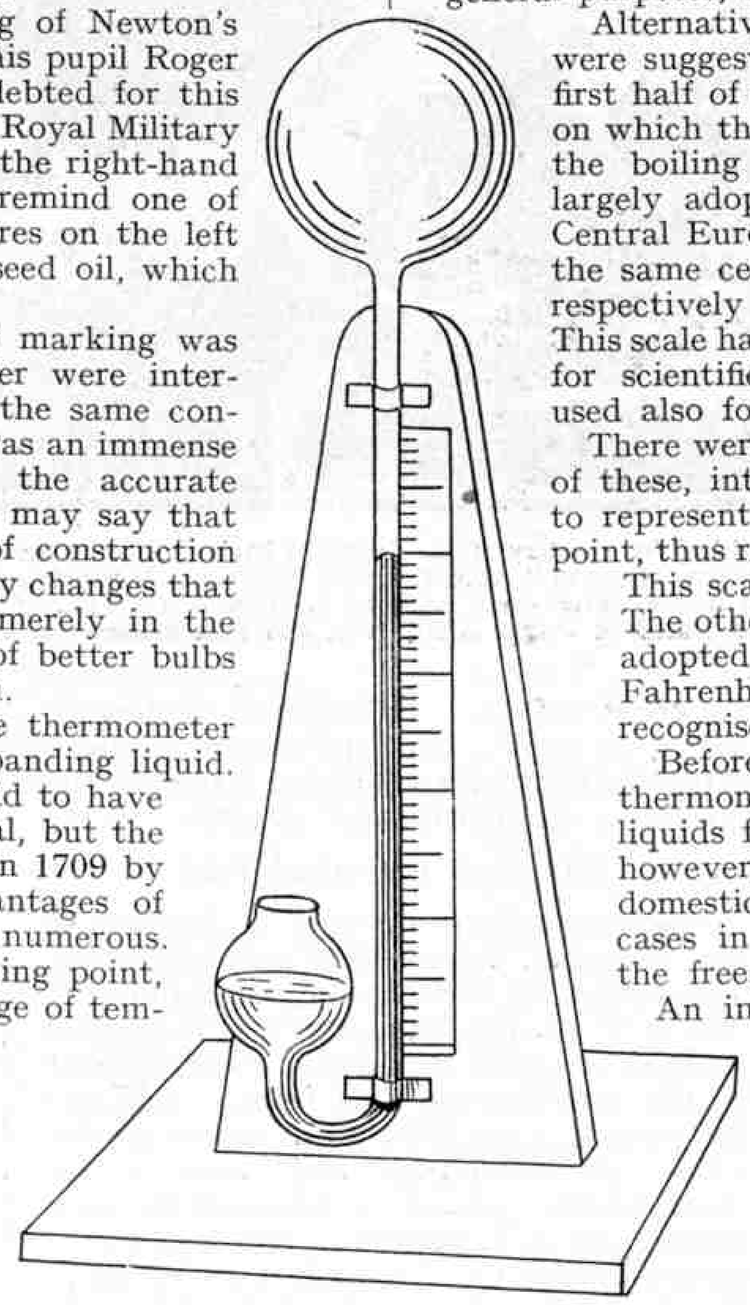
Alternative methods of dividing the thermometer scale were suggested by a number of scientific workers. In the first half of the 18th century Réaumur introduced a scale on which the melting point of ice was called 0 degrees and the boiling point of water 80 degrees. This scale was largely adopted on the Continent, and is still in use in Central Europe for general purposes. In the latter part of the same century Celsius chose 0 degrees and 100 degrees respectively for the melting and boiling points of water. This scale has now been adopted, under the name Centigrade, for scientific purposes. In many countries the scale is used also for domestic requirements.

There were proposed also a number of freak scales. One of these, introduced by D'Lisle in 1733, used 150 degrees to represent the freezing point and 0 degrees the boiling point, thus reading backward as compared with other scales. This scale was at one time extensively used in Russia. The other scales suggested from time to time were never adopted to any extent and at the present day only the Fahrenheit, Centigrade and Réaumur scales are recognised.

Before the end of the 18th century the mercury thermometer had superseded those made of other liquids for accurate work of all kinds. Even to-day, however, cheap spirit thermometers are used for domestic purposes, and other liquids are employed in cases in which the temperature to be read is below the freezing point of mercury.

An interesting development of the thermometer is that of the self-registering type. It is very desirable in weather observations to record the highest or the lowest temperatures that occur during the day and the night, and obviously it would be inconvenient to have an observer constantly watching the thermometer. This difficulty is overcome by the registering thermometer invented by James Sixe, of Colchester, in 1788. It is an alcohol thermometer in which the stem is bent into two parallel branches and the thread of alcohol interrupted by a length of mercury on each side of the bend. Above the mercury on each side is a small glass index shaped like a dumb-bell and held up by a

(*Continued on page 874*)



The air thermometer invented by Galileo about 1602

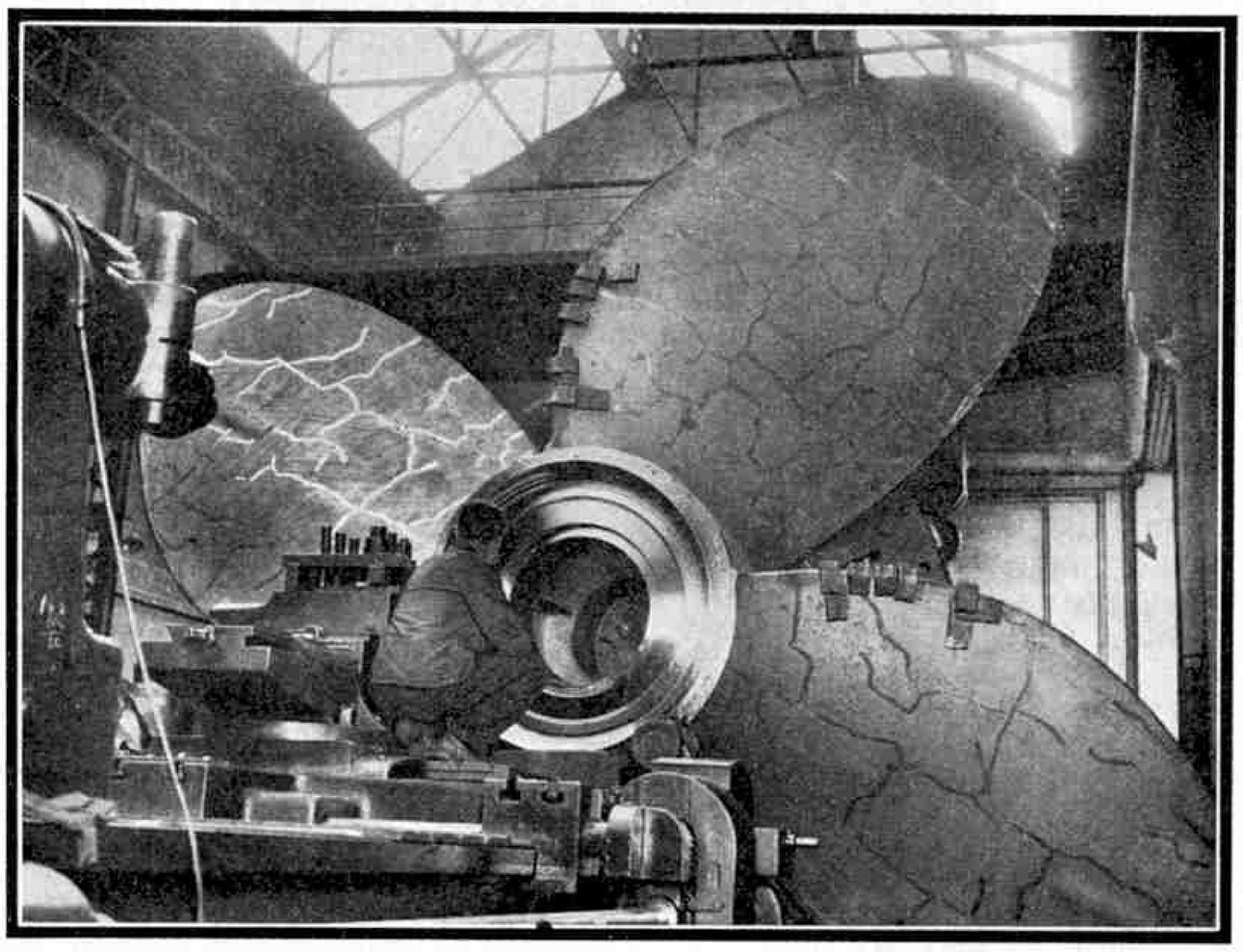
A Monster Excavating Machine

An interesting feature of the construction of excavating machinery is the rapidity with which large machines are being replaced by still larger ones. An extremely large machine constructed recently possesses a jib 100 ft. in length at the end of which operates a bucket capable of dealing with 20 cubic yards of material. The same machine can be modified to work with a jib 120 ft. in length and a bucket with a capacity of 15 cubic yards. This latter arrangement enables the machine to build a bank 70 ft. in height, as against a 50-ft. bank capable of being made when using the 100 ft. boom.

The immense size of this excavator may be gathered from the fact that the underframe is 45 ft. square, and owing to its weight cannot be mounted on wheels. Four caterpillar-tractor units are provided, one being situated at each of the four corners of the square. Each of the tractor units consists of two caterpillar belts, the widths of the treads being 3 ft. The total area of the belting continually in touch with the ground is 414 sq. ft. The excavator is operated by electricity, two 450 h.p. and four 150 h.p. motors being installed.

A New Link in the East Coast Road Route

A new bridge, which has been tested to withstand a load of 80 tons, has been opened near Cockburnspath on the Berwickshire coast. The bridge forms an important link in the East Coast road route, greatly increasing the usefulness of the new Newcastle and Berwick bridges. Only 15 months have been occupied in its construction. It is 200 ft. in length, 28 ft. in width, and provides a roadway 20 ft. in width for vehicular traffic. The cost was approximately £22,000.



Our photograph, published by courtesy of the Canadian Pacific Railway, shows on the lathe the propeller of the "Empress of Japan" (25,000 tons). This vessel is a twin-screw liner, and her propellers—the largest in the world—were made by J. Stone & Co. Ltd., of Deptford, London. Their finished machined weight is 20¼ tons, and their diameter is over 20 ft.

British Lorries for India

A contract from the Indian Government for 190 six-wheeled 3-ton road lorries has been secured by the Albion Motor Car Co. Ltd., of Glasgow. The value of this contract is estimated at about £200,000. Other contracts, valued at about £237,622, have been secured by Morris Commercial Cars, of Birmingham, for a number of their commercial lorries, including 38 six-wheeled 30 cwt. Morris lorries with bodies.

J. I. Thornycroft & Co. Ltd., of Basingstoke, are also supplying the Indian Government with more than 100 of their "A4" type rigid six-wheeled chassis. The total value of the Thornycroft contract is estimated at approximately £53,560.

The Indian Government intend to equip these lorries with bodies having a capacity of 3 cwt., and to employ some of them for the transport of supplies of food and other stores. A certain number, however, will be fully equipped for use as mobile workshops.

Navy and Pulverised Fuel

Speaking at the opening in London of the Shipping, Engineering and Machinery Exhibition, the First Lord of the Admiralty, Mr. A. V. Alexander, stated that the Naval Authorities were displaying great interest in the experiments now being conducted by private companies with regard to the value of pulverised fuel burners for marine work. Since this statement has been made, various shipbuilding authorities have stated that in their opinion it would be in the interests of British shipbuilding in general if the Admiralty themselves were to undertake a series of experiments with pulverised coal. The Admiralty may possibly agree to this proposal and equip a warship with the special burners required.

Weather Chart Wirelessed from Shore to Ship

The first synoptic weather chart ever transmitted by wireless photography and received by a ship at sea was flashed to the White Star liner "*Olympic*" during a westbound voyage a short time ago.

The chart, plotted by the meteorological office at London from information flashed from observation stations and from ships at sea, was transmitted by wire to the powerful wireless station at Daventry, England, and sent out from there to the "*Olympic*," which was then 500 miles away.

The photograph was recorded on the "*Olympic*" on a portable receiving apparatus called the "Fultograph," invented by Captain Otto Fulton, a British engineer, who was a passenger on board the liner. Later the chart was presented to Capt. W. H. Parker, the Commander, as a souvenir of the occasion.

The machine that makes possible the reception and transmission of photographs by radio or telephone is small enough to be carried in a container the size of a portable gramophone case.

Increase of Welded Buildings

The number of buildings erected by the use of electric arc welding has increased by 50 per cent. during the space of one year, according to the well-known American engineer, Mr. F. P. McKibben. In a list published by him in July 1928, only 100 welded structures were mentioned, including bridges, cars, cranes, ships, tanks, etc.; but this total, according to revised figures, is now 138.

In the list of a year ago, the number of welded buildings was 43, while the present total is given as 65. If to this total are added bridges and ships, the total is 95 as against 63 for a year ago.

An interesting feature of the use of welding is the increased height and size of buildings in which this method of structure has been used. Another interesting development is the comparative ease by which existing steel bridges can be strengthened by welding new steel on corroded or over-stressed members, a process applied not only to highway structures but also to railway bridges on many of the important lines throughout the United States.

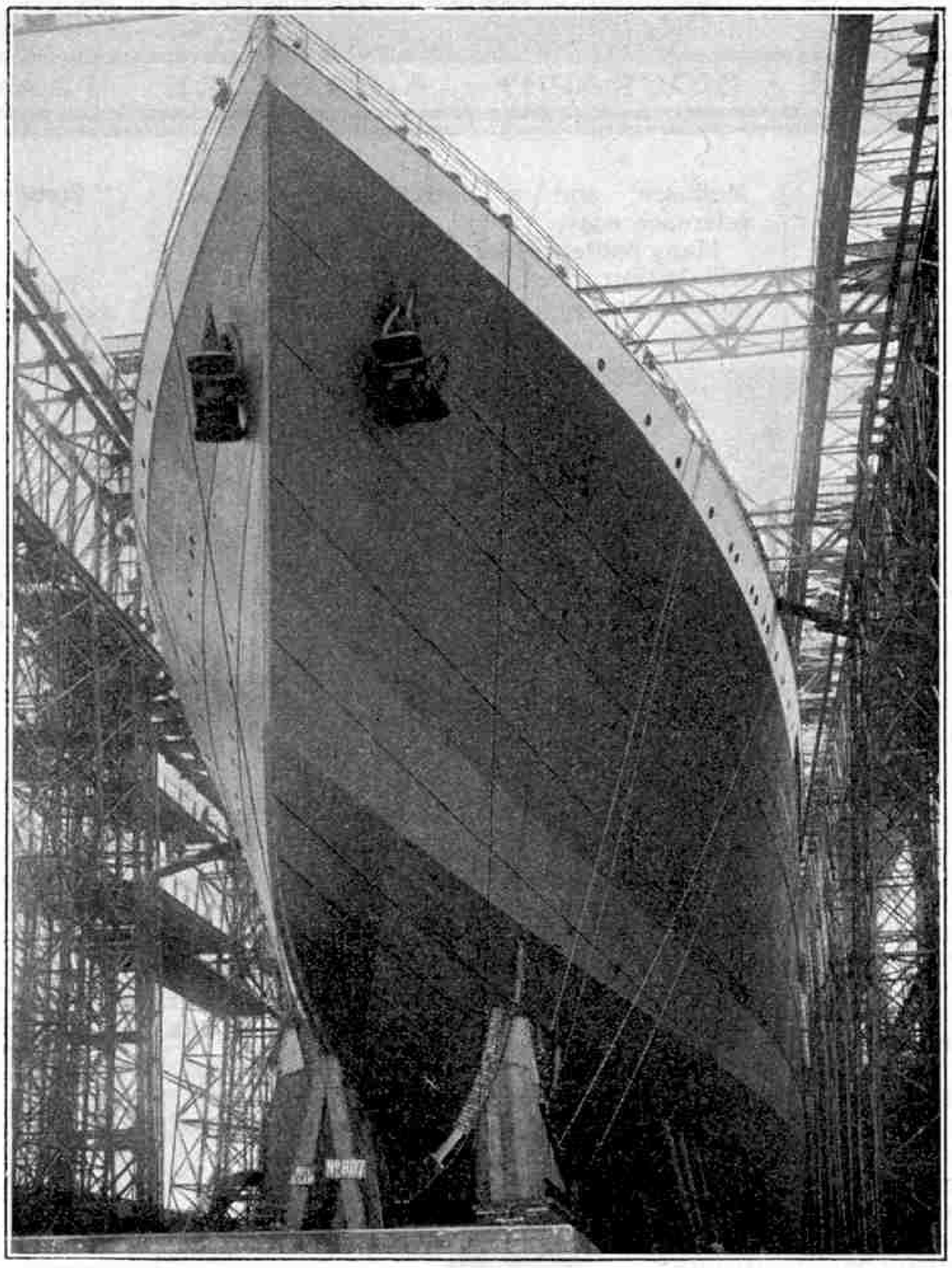
A Huge Swiss Power Station

Construction is now proceeding on a huge hydro-electric power station, which is situated near Grimsell Pass in Switzerland. The site of the station is a short distance from the summit of the Pass, where a dam is being constructed across the River Aar, a tributary of the Rhine, which flows through Lakes Brientz and Thun on its journey to the Rhine. The dam is 750 ft. in length, 340 ft. in height, and 230 ft. in thickness at its base, and is therefore probably the largest of its kind in Europe. The damming of the Aar will form a lake half-a-mile in width and about three miles in length, with a capacity of approximately 100,000,000 cubic metres of water.

The water from the artificial lake is to be directed into Lake Gelmersee through a tunnel three miles in length, which has been blasted through the mountain side. This lake already contains 13,000,000 cubic metres of water.

From Lake Gelmersee the water will be carried by means of pipes to the power house, where it will fall a distance of 1,620 ft. into four turbines possessing a total capacity of 120,000 h.p. After passing through these turbines the water will be directed through two further power stations, which will generate a total of 260,000 h.p. The electricity generated will be conveyed by means of high tension cables to Berne, Basel and many other large Swiss cities.

In order to carry on the construction of this work, it has been necessary to convey stores and tools to the workmen by means of trucks hauled across cables suspended 1,000 ft. up in the air. The scheme is expected to be completed towards the end of 1931, by which time a new road will have had to be constructed to take the place of the one that it will be necessary to submerge by the formation of the reservoir.



Courtesy] [*Harland and Wolff Ltd.*

Bow view of new White Star Motor Liner "*Britannic*" as she appeared on the stocks **(see page 836)**

Oil v. Steam for Ship Propulsion

The figures given in Lloyds Register of Shipping of the tonnage of merchant vessels under construction in British and foreign shipyards are very interesting, for a comparison with previous statistics suggests that the motor ship is not carrying all before it, as in recent years it has threatened to do. On 31st March last, 2,837,812 tons of merchant shipping were under construction, of which 49.32 per cent. were motor ships; whereas a year ago 51.53 per cent. of the corresponding total represented vessels equipped with internal combustion engines. In the interval this percentage has been as high as 56.4.

The same tendency is shown in regard to ships built in Great Britain. Of the 1,357,375 tons of merchant shipping on the stocks in British yards on 31st March this year, only 39.58 per cent. were motor ships, although six months ago the percentage was as high as 45.66. The drop may be only temporary and accidental in character, for it may indicate that work has been completed on a large number of motor vessels that have not yet been replaced on the stocks by new ones; and further developments in the race between steam and oil will be watched with considerable interest. The results of the many experiments now being conducted with pulverised fuel burners may also cause the popularity of the motor vessel to decrease still further.

In this connection the figures showing the total horse-power of the marine engines under construction throughout the world are of importance, for during the last six months there has been a remarkable increase in the horse-power of the steam engines fitted to vessels. From 30th September, 1928, to 31st March, 1929, the total horse-power of the reciprocating steam engines under construction rose from 414,001 to 573,508, an increase of 159,507 h.p.; while the horse-power of steam turbines under construction on the same dates also showed a considerable increase, amounting in this case to 139,100 h.p.

While it cannot be stated definitely that steam engines of all kinds are more than holding their own against the internal combustion engine, the increased popularity of both reciprocating steam engines and turbines is worthy of notice.

Enlarging a London Tramway Tunnel

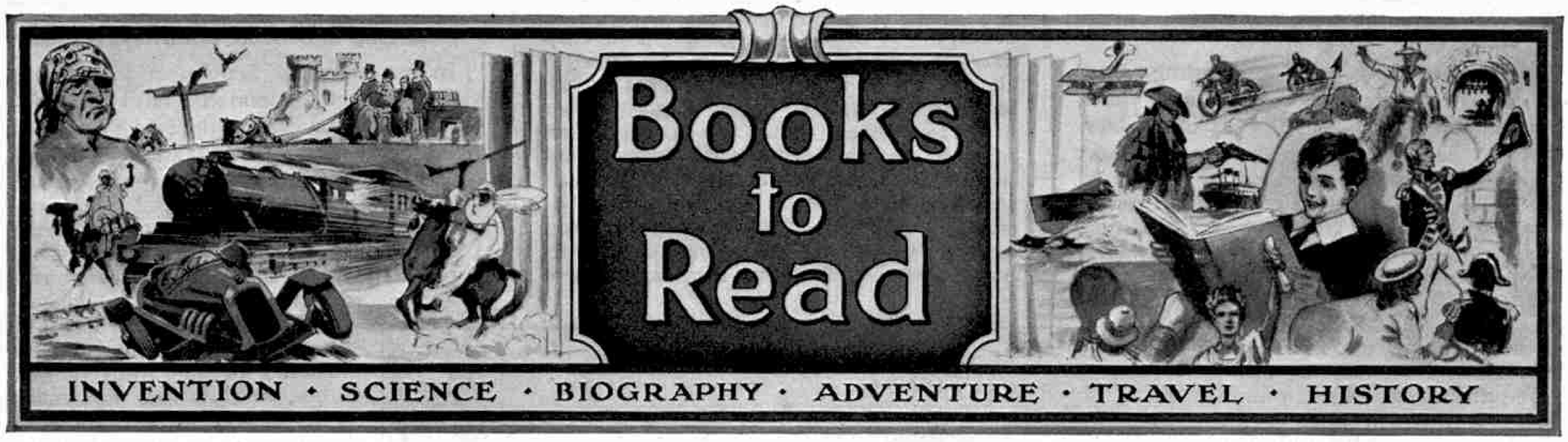
In our issue for September last it was stated that the London County Council had decided to grant applications to join buildings to tube railway stations by means of subways, in order to relieve congestion in the overcrowded streets. In this connection it is interesting to note that the tramway tunnel that runs from the Victoria Embankment to the junction of Southampton Row and Theobalds Road is being enlarged. The tunnel was originally constructed in the form of two tubes, and its size has made it impossible for the route to be operated by any but single-deck tramcars. The work at present in hand is estimated to cost at least £170,000 and provides for the removal of the ground separating the two tubes. This will make one large tunnel through which it may be possible to build a road over which buses and other motor transport vehicles may pass. The preliminary preparations are expected to be completed by the beginning of next year, after which it will be necessary for the tunnel to be closed to tramcar traffic until March 1931, by which time the work should be finished.

Railway Station as Omnibus Garage

A remarkable feature of transport during the past twelve months has been the immense increase in popularity of long-distance bus journeys. Even as recently as the beginning of 1928 bus routes were confined mostly to towns and their outlying districts. It is now possible, however, to travel almost anywhere in a well-upholstered saloon bus, and in fact many journeys such as that from Liverpool to London are operated daily. A similar state of affairs has been experienced in the Irish Free State, where this form of transport has become a very formidable rival of the railways. An example of this can be seen in Dublin where Broadstone Station, a terminus of the Midland Great Western Railway, has been reconstructed to enable it to be used as an omnibus garage. The permanent way between the various platforms of the station is being filled in, just two lines of rails being left standing to deal with rail traffic. The rest of the station will be fitted up with modern appliances, and in a short time will become one of the best equipped garages in the whole of Ireland.

New Use for the Seismograph

A new use for the seismograph, or earthquake recorder, has been found in California, where several of these instruments are being installed along selected main roads, in order to register the vibration caused by passing traffic. In this way data can be obtained that will make it possible for road-builders to construct roads capable of withstanding the stresses set up even by the heavy lorries that are using the roads in increasing numbers.



On these pages we review books that are both of interest and of use to readers of the "M.M." We have made arrangements to supply copies of any of these books where readers find difficulty in obtaining them through the usual channels.

Orders should be addressed to the Book Dept., Meccano Limited, Old Swan, Liverpool, and 1/– should be added to the published price of the book to cover the cost of postage. The balance remaining will be refunded when the book is sent, as postages on different books vary according to the weight and destination.

"Shell Life"

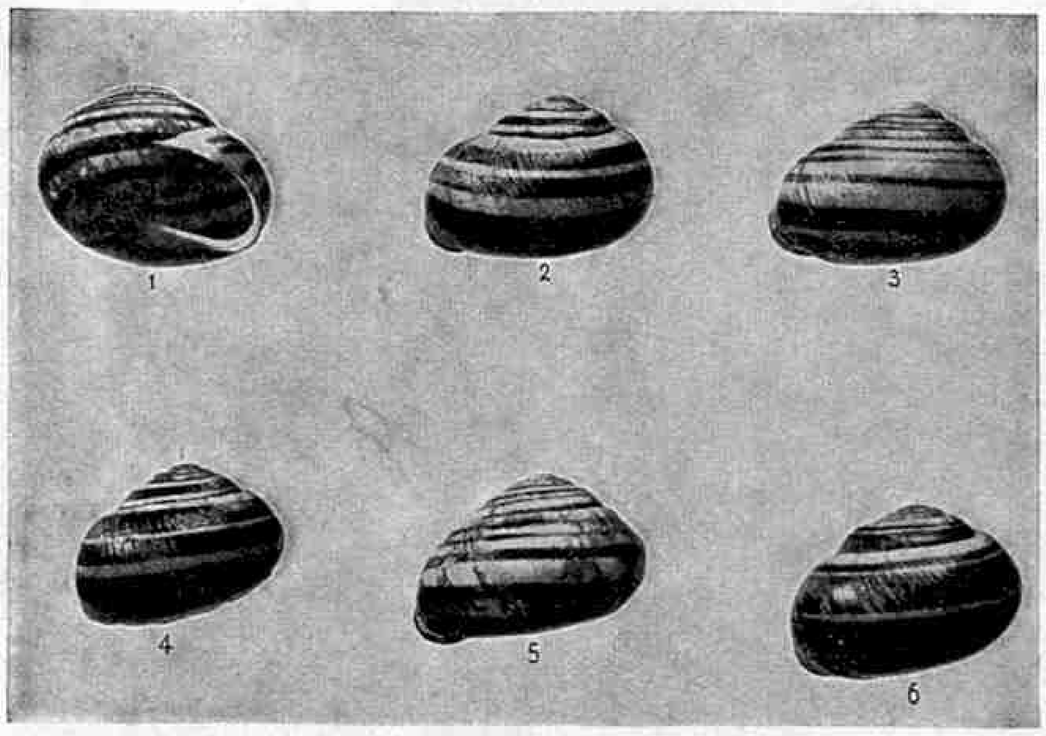
By EDWARD STEP (Warne. 7/6)

Any book by Mr. Edward Step is sure to have an enthusiastic reception from nature lovers, for his "Wayside and Woodland" Blossoms, Flowers and Trees are three volumes that have long been popular and deservedly so. In his latest book Mr. Step introduces us to British Mollusca, and with the aid of 600 illustrations, nearly 200 of which are in colour, he makes his subject both clear and interesting.

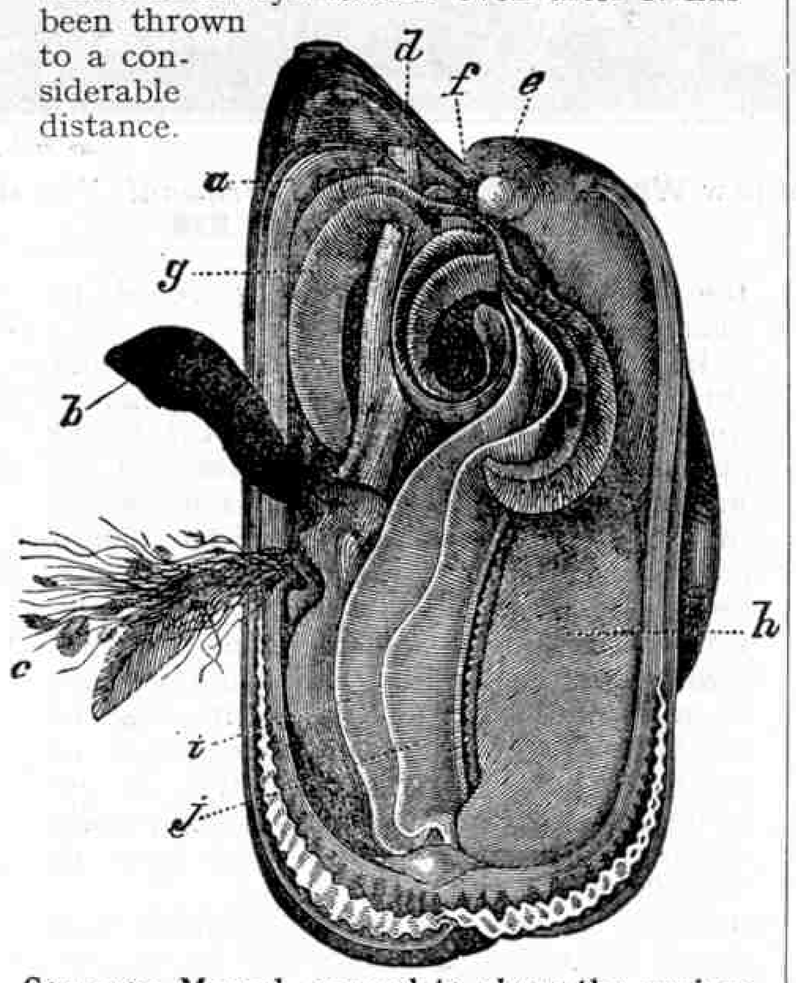
When he wrote his books on wild flowers and kindred subjects, Mr. Step's intention was to awaken an interest in Nature, in the hope that a closer study would be made of form and habit, and the same purpose lies behind the present volume. In the first place we read of the outstanding characteristics of the prevailing types of structure, as shown by such familiar examples of shell life as the snail, the mussel, and the cuttle. This enables us to follow with clearer understanding the story of the species in the latter chapters, from which we get an intelligent idea of the sub-kingdom in so far as it is represented in the British Isles. With access to this book there should be no difficulty in distinguishing most of the species commonly encountered in the woods and lanes, ponds and streams, or along the seashore.

We are told that there are 750 species of Mollusca in this country and the adjacent seas, and of these no fewer than 650 are described in this book. There must be many readers of the "*M.M.*," both young and old, who have devoted some of their holidays to making collections of shells. Such collections become much more interesting if the names and histories of the specimens are familiar to the collector. The book is not a handbook intended solely for the shell collector, however, but is rather written with the idea of drawing attention to these creatures as living organisms. The diversity of their form and structure have an intimate relation to their mode of life, persecution of enemies, and other factors in the struggle for existence. In an appendix there is included a classified list of British Mollusca, and a useful index makes reference easy.

Many readers of Mr. Step's book probably will be surprised to find how interesting Mollusca are. This is the case with such an ordinary creature as the common garden snail, which is remarkable for possessing a home—or at least, a roosting place—to which it always returns even after it has been thrown to a considerable distance.



Six variations in colour and banding of the white-lipped snail (*Helix Hortensis*). This illustration and the one below are taken from "Shell Life" reviewed on this page



Common Mussel, opened to show the various organs and represented actual size, see above

(a) mantle edge ; (b) foot ; (c) byssus ; (d, e) muscles of the foot ; (f) mouth ; (g) lips ; (h) lobe of mantle ; (i, j) gill plates

"Constructive and Decorative Woodwork"

By A. C. HORTH

(Pitman & Sons Ltd. 2/6 net)

The latest volume to hand of Pitman's excellent "*Crafts-For-All*" series deals with simple constructive and decorative woodwork. This volume not only maintains the high standard already set in this series, but seems to us to go a little further in the practical nature of the instruction given. The style is so simple that it is impossible to misunderstand the writer's meaning, and the half-tone illustrations showing the correct method of using various tools are among the best we have seen. There are also many line drawings illustrating various matters of detail as they occur in the text.

Commencing with a description of the tools and equipment of the woodworker and how they should be handled, the author passes on to deal with the various essential joints, and gradually leads the reader on to simple cabinet work in the construction of a variety of useful household tables, stands, cabinets, etc. The book concludes with a short description of methods of wood-finishing, including staining, varnishing and polishing.

"The Book of Nonsense"

By LEAR, CARROLL AND OTHERS

(Dent & Sons Ltd. 2/–)

That there is more than one kind of nonsense is very apparent to readers acquainted with the diverting work of such writers as Edward Lear and Lewis Carroll. (We had an article in the "*M.M.*" a little time ago in which we described Edward Lear's nonsense rhymes and sketches, and in which we told the story of his life). The present book is a re-issue, as volume No. 806 in the popular "Everyman's Library," of part of Edward Lear's first book of comic drawings and limericks. The remainder of the book is made up of a collection of nonsense in verse and prose from many old favourites.

Three generations of "young people of all ages" have laughed at Lear's quaint rhymes, and it is convenient to have many of them in this handy form, together with other equally readable "nonsense" illustrated by numerous whimsical sketches. It would be difficult to find any book that is equally readable by the inhabitants of the nursery and by grown-ups, but in this volume there is much that will appeal to both classes —to say nothing of the intermediate class of "Meccano" boys. The pages are made even more interesting by a number of whimsical sketches.

Pioneers of Wireless

By ELLISON HAWKS (Methuen. 12/6)

Although the present is often spoken of as the "wireless age," communication without wires is by no means as new an invention as some people imagine. Even from the beginning of things, for instance, the inhabitants of the forest have signalled the presence of a marauder, whether man or beast, with incredible speed. Electricity and magnetism, the bases of wireless communication, have been the subjects of study for four centuries and later workers have built on the all-important investigations of those pioneers whose work is the subject of this fascinating volume.

The book is a revelation—for we find that there has been a veritable army of workers in both the old and the new worlds who made the recent dramatic steps in wireless discovery so sure as to be almost commonplace. Although Marconi has captured public imagination, his work was the superstructure that rested on foundations well and truly laid by men like Morse, Righi, Popoff, and Branly, the value of whose work is often overlooked. To retrieve these early workers and their achievements from the field of the forgotten is the task the author of this book (who is also the Editor of the "*M.M.*") has set himself—a by no means easy task, for years of research work were necessary to complete the records of the pioneers and to collect their photographs.

The book is packed with wonderful information—we learn, for instance, that the Chinese knew of the properties of magnetic ore in remote days—a Chinese Emperor tracked his enemy by the magnet in 2000 B.C.; that Homer, 1000 B.C., mentions the power of the lodestone; that possibly the Crusaders brought the magnet into Europe; that the Fleur-de-lis on compasses was the impress of the arms of Naples and dates far back in European history; that the Emperor Theodorus was appointed by the use of a magnetic ring that spelt out his name, and much more interesting information of the same order.

Coming, now, to the work of the individual pioneers, we read that in 1616 Barlow published his "*Magnetical Advertisements*"; and Gilbert, in the time of Elizabeth, his "*De Magnete,*" both of which works awakened some interest in the subject. Von Kleist's discovery of the Leyden jar in 1745, and Benjamin Franklin's experiments in the same connection were followed by Galvani's discovery of current electricity in 1780 by his experiments on frogs' legs. Volta discovered the possibility of generating electricity by chemical means in 1800. Oersted demonstrated the connection between magnetism and electricity in 1820, and with Ampere's discovery of the electric circuit, the way was paved for the electric telegraph.

The number of workers was steadily increasing, the outstanding feature of the next period being the work of Sturgeon and Henry, both pioneers of electro-magnetism. Henry has more than one claim to fame, for not only did he discover induction, but also the principle of the variometer used in radio and the oscillation transformer. The romantic biography of Michael Faraday, who from being a lowly bookbinder rose to become a scientific leader, will stir the imagination of every "*M.M.*" reader, and his discoveries in magneto electricity form the basis of modern electric power generators.

The Marconi Receiving Station at Glace Bay, as originally installed. One of the illustrations from "Pioneers of Wireless" reviewed on this page

Heinrich Hertz, the German physicist and experimenter who discovered the waves in ether that bear his name. See above

Then we pass on to signalling by electricity—the discovery of "earth return" by Steinheil in 1839, and Morse's invention (in 1835) of the code that bears his name and his electric telegraph. Morse also invented the relay in 1835 and was the first to experiment in wireless communication by conduction, a method that Lindsay also investigated independently. Bell's great invention—the telephone—was an epoch-making invention for wireless, and even at this comparatively early date Bell experimented successfully with a wireless telephone, using a ray of light to transmit speech. Wireless, as we know it, was slowly drawing nearer becoming a practical proposition and Dolbear, an American scientist, nearly forestalled Marconi when in 1883 he succeeded in transmitting without wires. Hughes, Clerk Maxwell, Hertz, Righi Popoff and Tesla followed in quick succession, each making advances of merit.

To all these—and many other wireless pioneers—the author has devoted time and care in his treatment of their work and in his biography of them. In the compass of this review one cannot do anything more than record the fact that he has done justly by each of them as well as by those who follow—Lodge, who failed to seize the opportunity of wireless telegraphy, though his researches enabled others to do so; Marconi, the young Italian who was the first to evolve a practical system of wireless by radiation. Fleming's discovery of the principle of the Thermionic valve, and de Forest's addition of the third electrode, opened up a new era in wireless and superseded the arc and generator, the pioneers of which were Duddell, Fessenden, Goldschmidt, and Alexanderson.

"Pioneers of Wireless" is a remarkable book not only because it is our first history of Wireless, but also because it travels over wide and varied fields with an intimacy that holds the reader spell-bound. Wireless enthusiasts will be grateful for this volume of living interest so graphically written, and on which both author and publisher are to be congratulated.

REV. J. H. MARTIN.

"Uncle Elephant's Adventures"

By R. BIRD
(Fredk. Warne & Co. Ltd. 2/6)

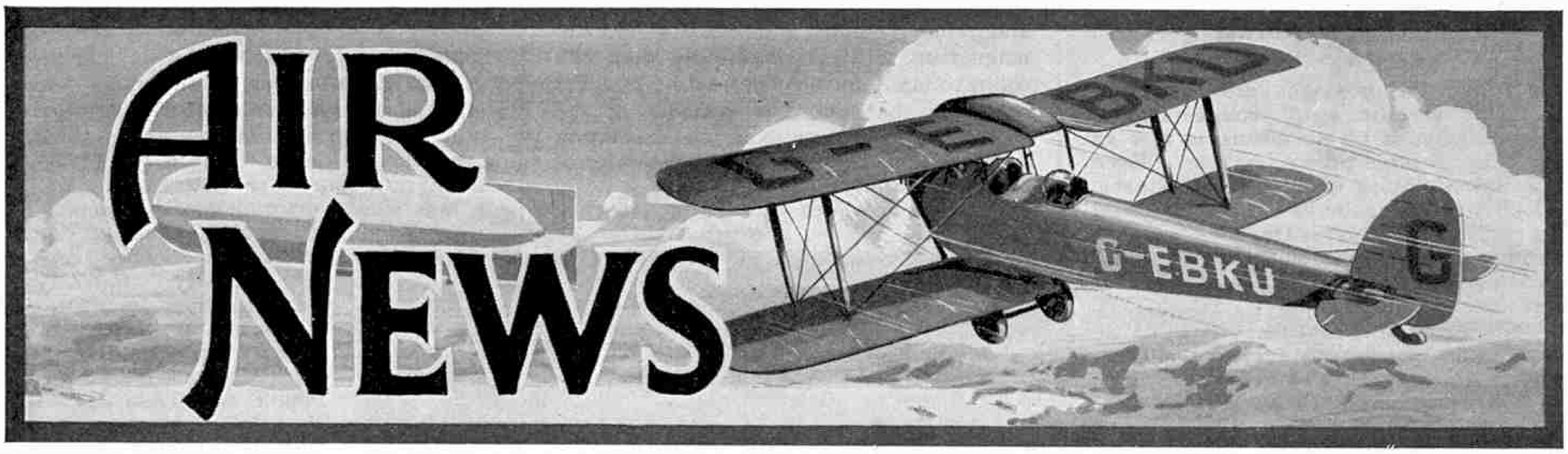
There is nothing that brings greater enjoyment to any tiny reader than a simply written and charmingly illustrated book about animals. Here we have a collection of stories that sparkles with clean and wholesome humour, giving a laugh on every page. The amusing adventures of dear old Uncle Elly-Pelly and his tiny nephews and nieces will bring sunshine and laughter to the nursery. The stories are just the right length for the little ones and children will never tire of having them read to them. [The present writer realises this only too well as he has just had to read this book for the third time in a week to satisfy a clamouring youngster, aged five!—E. H.]

Interesting Books Received

We hope to deal with the undermentioned books in an early issue.

"THE FIGHT FOR THE ASHES"
(G. G. Harrap & Co. Ltd. 15/-)

"FROM THE IVORY COAST TO THE CAMEROONS" *by* A. J. Reynolds.
(Alfred A. Knopf Ltd. 12/6)



Safety-First Air Tests

An interesting test was carried out on an Armstrong Whitworth "Argosy" aeroplane on its delivery to Imperial Airways. The aeroplane was loaded up to its full capacity of 5,000 lb., with petrol for four hours. There was very little wind, but the weather was hot and the air somewhat bumpy.

The aeroplane left the ground in 11 seconds and climbed to a height of between 2,000 and 3,000 feet. Each of the Armstrong Siddeley "Jaguar" engines was then switched off in turn for a period of 10 minutes, and the machine was flown on the two remaining units. It was found that a height of over 2,000 ft. could be maintained with any one engine stopped while flying at an air speed of between 75 and 80 miles an hour. The performance was a little better with the two wing engines running and with the centre engine stopped, the aeroplane climbing steadily in this condition.

The behaviour of the engine that was switched off was interesting. At first the airscrew continued to turn the engine at a very slow speed, but after about five minutes it stopped. In order to start the engine again the aeroplane was speeded up to about 100 miles an hour by diving slightly.

Policing the Air

A short time ago the French Air Ministry organised a force of aerial police to deal with any contravention of the law taking place in the air. These police are provided with specially equipped aeroplanes with which they are able to pursue law-breakers. To order any aeroplane to stop, they fire a harmless bomb that emits dense clouds of black smoke immediately upon exploding.

Interesting Non-Stop Flight

A non-stop flight between Vancouver B.C., and Agua Caliente, Mexico, has been accomplished by an American aviator flying a "Great Lakes" 2T–1 type light aeroplane fitted with an American "Cirrus" engine developing 90 h.p. The distance between these two places is 1,350 miles, which was covered in the excellent time of 13 hours 8 mins.

New Imperial Airways Machines

According to an official statement, the three Armstrong Whitworth "Argosy" aeroplanes for the Silver Wing service of Imperial Airways Ltd., which were delivered during July, are to be named after three famous cities. G-AACH will be named "*City of Liverpool*"; G-AACI, "*City of Edinburgh*"; and G-AACJ, "*City of Manchester.*" Another of these machines has been ordered from the Sir W. G. Armstrong Whitworth Aircraft Co. Ltd., and is expected to be ready shortly.

Imperial Airways also have three other large air liners on order. These machines are being constructed by Handley Page Ltd., and will be used on the long-distance routes of Imperial Airways. They are considerably larger than any other British machine that has been constructed for passenger carrying. There are two main cabins, each accommodating 20 passengers, and elegantly upholstered and panelled in walnut. They are joined by a corridor from which opens a completely equipped buffet and toilet compartment for each cabin, while a special luggage compartment is also included. Although the machines will be of the biplane type, the cabins will be below the lower plane, thus greatly reducing the noise and providing an uninterrupted view of the countryside below. They will be equipped with four engines, two of which will be situated on the upper and two on the lower plane.

We hope shortly to publish further details and photographs of these machines.

Aerodrome for Thornaby-on-Tees

A well-known Gateshead-on-Tyne firm of constructional engineers have received a contract for the construction of a new aerodrome at Thornaby-on-Tees. The aerodrome will include a large hangar, 250 ft. in length, 85 ft. in clear width and 20 ft. in height.

A Blériot 61 machine equipped with a Lorraine 450 h.p. engine. Aeroplanes of this type achieved great fame during the days of the Great War, and were known as "*Spads*"

The Prince as Private Owner

The Prince of Wales has purchased a two-seater De Havilland "Moth" light aeroplane equipped with a D.H. "Gipsy" engine. The machine is intended for his own personal use and is finished in the red and blue colours of the Brigade of Guards Light Aeroplane Club. It is fitted with dual control and has been given the registration number G-AALG.

Readers will probably remember that up till now an R.A.F. machine has always been at the Prince's disposal, and in this connection it is interesting to note that, although during the War the Prince made great use of aeroplanes, his first flight after the Armistice was made on 4th May, 1926, just after the start of the General Strike. On this occasion the Prince flew across the Channel in an Imperial Airways Handley Page "W.10" type machine equipped with two Napier "Lion" engines. This was the first cross-Channel flight he had ever made, and the experience proved so novel that he spent a great deal of the time in the pilot's cockpit.

It has been stated that the Prince does not intend to take out a Pilot's "A" Certificate, and Mr. E. H. Fielden, A.F.C., an ex-R.A.F. officer has been appointed as the Royal pilot.

Flying Rats !

One of the queerest cargoes yet carried on the cross-Channel service of Imperial Airways was a consignment of Albino rats. A colony of these rats is kept in London, and they are constantly in use for research work upon the vitamin D element ostelin. This research work has become well known to scientists the world over, and a request was received for the despatch of a number of these interesting rodents to Spain, where they will be used for scientific research purposes in the University of Barcelona.

New World's Altitude Record

Since the breaking of the French altitude record for light aeroplanes weighing less than 880 lbs. was reported in our last issue, a new world's altitude record of 25,000 ft. for machines in this class has been set up in a Beazley NB-3 monoplane equipped with an Armstrong Siddeley "Genet" engine.

Further Handley Page Slot Developments

One of the most remarkable features of aeronautical progress during the past few years has been the popularity attained by the Handley Page automatic slot. This device, as our readers will remember, increases the safety and control of an aeroplane by postponing the stalling point. Since its invention in June 1927 it has been fitted on 11 standard types of machines used in the Royal Air Force, in addition to the Short "Calcutta" flying boats, the latest Armstrong Whitworth "Argosy" machines, and various light aeroplanes.

It has now been found that at the slow flying speeds possible on slotted machines the ordinary controls are frequently ineffective. When one wing of an aeroplane is forced down by a current of air, the aileron on that side is lowered and the one on the other wing raised. This brings the machine level once again, but puts it slightly off its course unless this movement is counteracted by use of the rudder. When this operation is carried out on a slotted machine flying below its normal stalling speed the lift caused is practically negligable, but the "drag," or wind resistance, becomes very great, swinging the aeroplane right off its course, and possibly into a spin.

In order to prevent this effect a new "interceptor slot" has been invented by Mr. Handley Page. It consists of a hinged plate, slightly shorter than the automatic slot and from two to three inches in width, which is fastened on to the wings just behind the leading edge. The interceptor slot fits flush with the surface of the wing when the aileron on that side is in the normal position or sloping downward. When the aileron is raised, however, the interceptor plate moves upward until, when the aileron is raised as far as possible, the plate is at right angles to the wing. This causes a great increase in resistance, overcoming the lift of the wing, which therefore stalls to the level of the other wing, so righting the machine. The fitting of automatic and interceptor slots on an aeroplane obviates the use of the rudder to counteract the lateral movement set up by the use of the ailerons.

Lower Fares for Northern Air Lines

The "air-taxi" service run by Northern Air Lines has proved to be such an unqualified success that the passenger rates have been reduced by 33⅓ per cent. It is possible for a journey to be made in one of their machines at an inclusive cost of 10d. per mile! When two or more passengers are flying in the same machine, the charge is reduced to 9d. per person per mile—actually less than the cost of travelling in a taxi-cab.

The Ford Monoplane

The Ford 14-passenger monoplane is undoubtedly the most popular of the larger-type commercial machines operating over airlines in North, Central and South America. The machine is of all-metal construction and is of the high-wing cantilever type seating 14 passengers, a pilot and a mechanic. The machine has been designed solely for commercial purposes, and has a maximum speed of 135 m.p.h. and a cruising speed of 115 m.p.h. It lands at 60 m.p.h. and has a service ceiling of 18,000 ft. The tare weight of the machine is 7,600 lb., and the loaded weight 13,500 lb., giving a useful load of 5,900 lb.

The monoplane is powered by three Pratt and Whitney "Wasp" engines, giving a total horse-power of 1,275. In a similar manner to the Armstrong Whitworth triple-engined "Argosy" machines used on British airlines, the Ford machine is capable of flying with a sufficiently large factor of safety even when any one of its three engines is shut off.

Courtesy [*Imperial Airways Limited*

Imperial Airways machine G-EBBI "Prince Henry" at Croydon Aerodrome after completing 500,000 miles of flying, a feat claimed to be unique in civil aviation.
The machine is a Handley Page "W.8" type aircraft, equipped with two Rolls-Royce "Eagle" engines. It has been in regular use on Imperial Airways London-Continental services for six years

THIS MONTH'S AIR STORY

"How did you get here?" asked the hospital doctor.
"'Flu'," replied the patient!

Interesting features of the machine are the substitution of a tail wheel for the more usual tail skid, and the provision of independently operated hydraulic brakes on all three wheels. The brakes enable the machine to be easily manœuvred when on the ground without any necessity for a handling crew, a factor which greatly decreases the cost of upkeep and correspondingly adds to its utility.

Autogiro's Long Flight

A 350-mile flight between Madrid and Lisbon has been made by a Spanish pilot on a Cierva Autogiro. The journey occupied four hours and during the whole of the flight strong headwinds were experienced.

Hispano-Suiza Aero Engines

One of the most interesting French aero-engines at present in production is the Hispano-Suiza 12 Nb type engine. This is of the direct-drive type and possesses 12 cylinders set in two banks of six at an angle of 60 degrees. The cylinders have a bore of 5.9 in. and a stroke of 6.69 in., while the overall length, height and width of the complete engine are 5 ft. 10 in., 3 ft. 4¾ in., and 2 ft. 7½ in. respectively. The weight complete is about 1,032 lb.

When working at an engine speed of 2,000 r.p.m. the normal horse power developed is 650, but this output may be increased for a short time to as much as 760 h.p. The normal fuel and oil consumption is 42.25 gallons, and 6.5 pints, per hour, respectively.

The Hispano-Suiza 12 Hbr type engine is similar to the 12 Nb, but is slightly less powerful and is fitted with a 2 to 1 reduction gearing. The bore and stroke of the cylinders are 5.51 in. and 6.91 in. respectively, while the total length is 6 ft. 2 in., the height 3 ft. 3½ in. and the width 2 ft. 4¾ in. The complete weight is 1,018.6 lb., and the normal output 500 h.p., working at an engine speed of 2,000 revolutions. The maximum horse power obtainable is 583, while the normal fuel consumption is 33 gallons per hour and the normal oil consumption 6.35 pints.

London-Paris Theatre Trips by Air

An interesting and novel experiment has just been tried by one of the tourist agencies. At an inclusive fee of 15 guineas per passenger, a party was organised to fly in a specially chartered air liner from Paris to London. Dinner at an hotel, followed by a theatre, supper and a cabaret, comprised the evening's programme, and the party flew back to Paris in time for breakfast next morning. A similar excursion was run subsequently from London to Paris, and it is hoped to make these "Aerial Theatre Services" a weekly institution.

New Night Mail Service for London

A new night mail service between London and Brussels was inaugurated at the beginning of last month. The service is operated by the Sabina Company, and will result in mails posted in London before midnight being delivered at their destination in Brussels with the first post. Mails will also be carried from Brussels to London for early delivery. A unique feature of the service is that, for the time being at least, no fee other than the ordinary postage is to be charged—undoubtedly a step in the right direction.

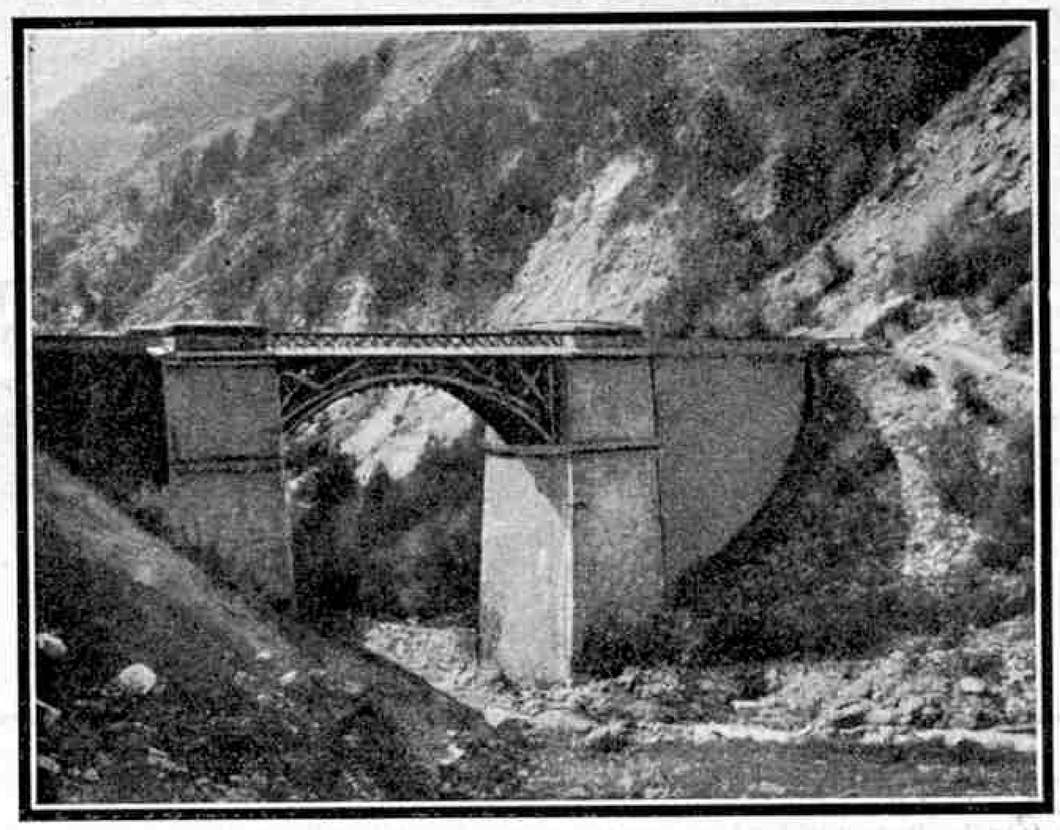
FROM OUR READERS

These pages are reserved for articles from our readers. Contributions not exceeding 500 words in length are invited on any subject of general interest. These should be written neatly on one side of the paper only, and they may be accompanied by photographs or sketches for use as illustrations. Articles that are published will be paid for at our usual rates. Statements contained in articles submitted for these pages are accepted as being sent in good faith, but the Editor takes no responsibility for their accuracy.

Over and Through the Simplon Tunnel

While staying in Switzerland I decided to make the journey across the Simplon Pass by the famous road constructed by Napoleon Bonaparte in 1807. For the journey the party with which I was travelling chartered a Swiss motor post coach. It was very sumptuously fitted, and it traversed the Pass from Brigue in Switzerland to Iselle, the Italian frontier station, in just over three hours. This was excellent time for a journey over such a difficult route. The road is 29 miles in length, and reaches a height of 7,000 ft. It passes through the most rugged mountain scenery, and even to-day its construction would be regarded as a triumph of engineering.

Two of the most interesting features of the road over the Simplon Pass are the Ganter Bridge, the arch of which is constructed entirely of unpainted wood, and the Kaltwasser, or Cold Water, Gallery. The latter is a masonry tunnel that carries the road immediately beneath a rapid stream issuing from a glacier a few hundred feet above. Unfortunately the tunnel is by no means waterproof and the icy water that trickled on our heads from the roof convinced us that the stream above was accurately named!



The Ganter Bridge, a wooden structure by means of which the road over the Simplon Pass crosses a mountain stream

After traversing the Gallery the highest point of the Pass was soon reached, and then we ran downhill to Iselle. On the way we passed both the Old and the New Hospices, which belong to the same order of monks as the similar but better known Hospice of St. Bernard.

As the members of our party did not wish to enter Italy we decided to return by way of the world-famous tunnel under the Pass. This is the longest tunnel in the world—more than 12 miles—and is double, the two galleries of which it consists being connected by frequent cross headings. Our train was in the tunnel for only 20 minutes and I was greatly surprised by the absence of the stuffiness usually experienced in railway tunnels. The reason for this is that electric power is used on Swiss railways and consequently there is no smoke to pollute the air in the tunnel.

W. S. GOODBODY (Bristol).

The stream of icy glacier water under which the Kaltwasser Gallery is driven

Secret Wireless Telephony

Recently I was fortunate enough to be invited to an interesting demonstration in New York of the voice-inversion method of secret telephony. In this a machine is used that changes high notes into low notes, and vice versa, before they are sent out over the connecting wires, or through the ether. A particular note is taken as the standard, middle C being chiefly used for this purpose. Its frequency is 256 vibrations per second, and a note of say 20 vibrations per second above this is transformed by the machine into one of 20 vibrations per second below. Similarly low notes are changed into higher ones, the frequencies of which are as much above that of middle C as those of the original notes were below this standard. A similar machine in the receiver restores the original sounds.

The effect of these changes of frequency is extraordinary. Several gramophone records were played before the microphone of the machine, and the sounds that came out of the loud speaker attached to it were the weirdest I have ever heard. It was utterly impossible to recognise the original tunes in the inverted reproductions, while spoken words became mere gibberish!

To conclude the demonstration the operator startled his audience by making some very strange noises in front of the microphone when, to our surprise, genuine English words emerged from the loud speaker. The demonstrator explained that he had learned several "words" in the inverted "language," and he proceeded to teach them to those present, after which several were allowed to try them on the machine.

AUGUST B. MUNDEL (New York).

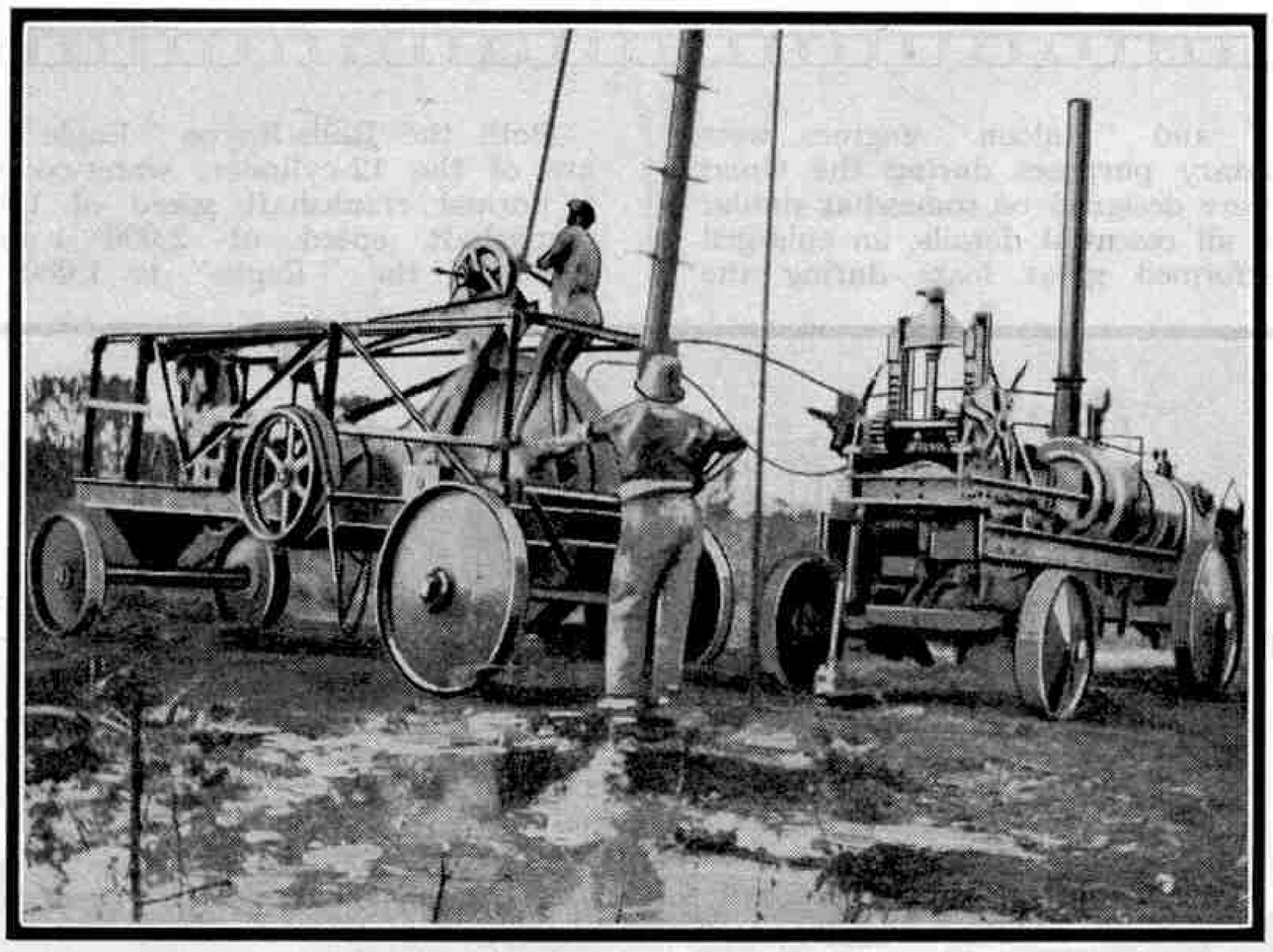
Boring a Well in South Africa

During my holidays I had the pleasure of watching the interesting process of boring a well on our farm. The outfit brought up for this purpose consisted of two portable machines of different types, each drawn by 14 oxen. The necessary tools and other accessories were carried on two ox wagons.

Two days were spent in choosing a site for the well and in getting the machines ready. The first of these to be tried was the "jumper," which bores a hole by repeated blows of a heavy bit. This is pulled up by means of a rope that runs over the top of a mast and round a steam-driven drum, and is allowed to fall on reaching a sufficient height to be effective.

A hole 3 ft. in depth was dug and water was poured down it in order to soften the schist to be penetrated by the drill. The jumper was then inserted. During the first day its action was a little uncertain, but it worked more effectively as the hole became deeper. After it had been working for some time it was taken out and a sand pump put down the hole in order to bring out the mixture of powdered schist and water produced by the operation.

After a few days' work it was found that the jumper had turned aside and the bore had become crooked. In order to straighten this it was decided to fill the hole with concrete and to bore through this with the rock borer, the second of the two machines.



Boring a well on a South African farm by means of a jumper, or heavy iron bit. This is repeatedly allowed to fall, after being raised by means of the rope shown in our photograph

Actual boring recommenced three days later. The rock borer is steam-driven and makes its way through the rock with the aid of small shot. These pass down inside the outer casement of the drill and on reaching the bottom work their way under the end of a rotating tube and grind away the rock. The material removed passes up the centre of the drill.

With this machine water was reached at a depth of 111 ft., and the success of our operations was dramatically announced by the sudden outburst of a jet of water that spurted in a magnificent arch to a height of 70 ft. above ground.

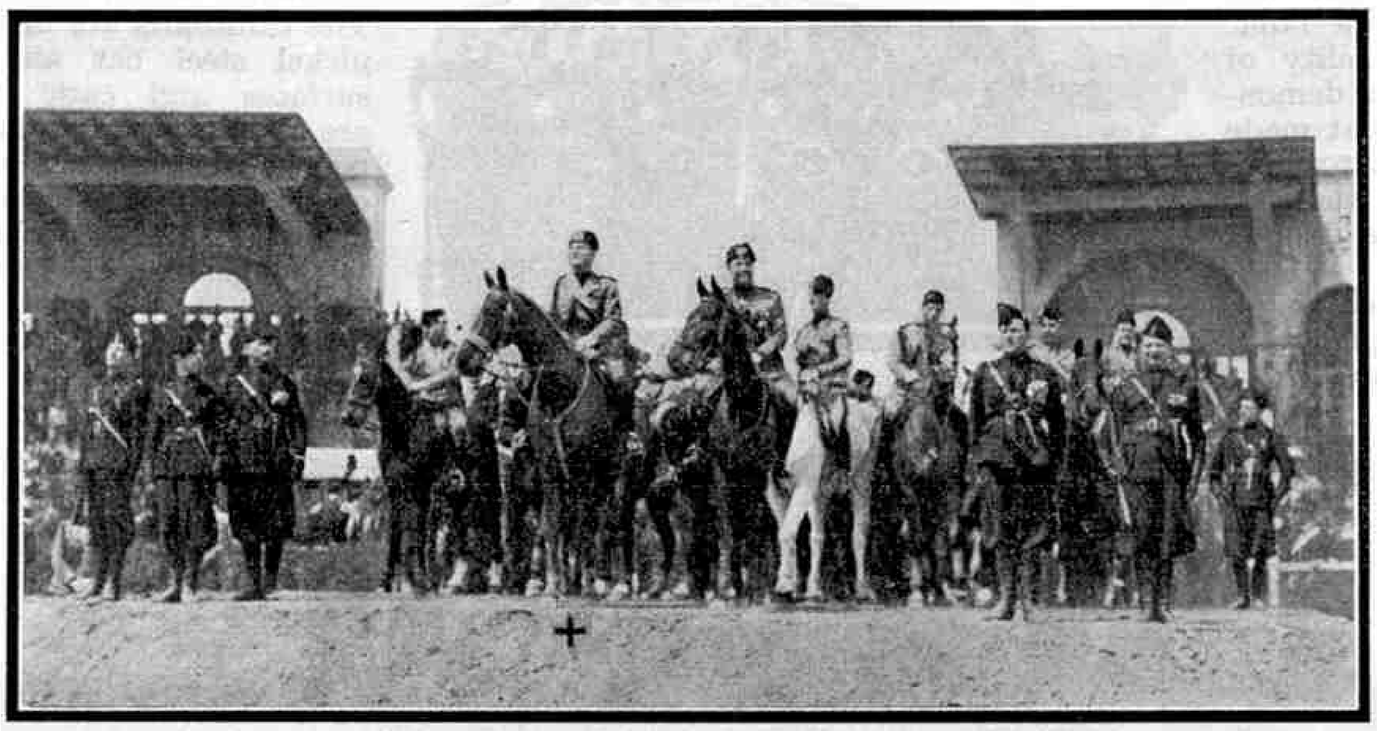
F. DAVIES (Gatooma, S.A.).

Reviewed by Mussolini

With my legion of Balilla, or boys under 12 years of age, I took part in a wonderful review of Fascisti held on the birthday of Rome, 21st April. For this wonderful event 15,000 Avanguardisti were brought from all parts of Italy and encamped under tents put up with the skill of real soldiers, although they were only boys between the ages of 12 and 17 years.

The weather on the morning of the review was hot and sunny, and the sight of the 50,000 Fascisti who were to march past the Duce made a wonderful impression on my mind. Signor Mussolini arrived at 9.30 a.m., mounted on a magnificent Arab horse and accompanied by a brilliant staff that included the famous airmen De Pinedo and Balbo. He was loudly acclaimed by the enormous crowd that had assembled to witness the review.

It would be impossible within a short space to give a complete list of the battalions, regular and volunteer, that during the next two hours marched past the Duce in an unbroken column. They included representatives of every Italian regiment—militia; "Battalions of Assault" with daggers and black helmets; Avanguardisti on skis, cycles and horseback; and finally the Balilla. As we passed, our leading officers shouted "The Duce," and we boys gave the Fascisti salute as we answered "A Noi!" or "To us the defence of the Duce."



Signor Mussolini (marked by a cross) at a review of Fascisti. (Incidentally, this appears to be a "freak photograph," for what has become of the head of the white horse to the right of Mussolini?)

After the review was over, all gathered in the Hippodrome close by for the ceremony of the "*Leva*," or call to arms, when the Avanguardisti who have reached the age of 18 years are incorporated in the National Militia. At this Signor Mussolini and his staff assisted, and a very solemn and moving scene was presented as every man present took the Fascisti oath with uplifted arm.

Then the discipline of the review was loosened, and 50,000 Fascisti immediately shouted themselves hoarse, waving their caps in the air, brandishing their daggers and singing their songs, breaking off only to cheer the Duce, who was delighted by the display of enthusiasm at this wonderful review.

P. MOLAJONI (Rome).

Famous Aero Engines

IX.—The Rolls-Royce "Eagle" IX and "Falcon" III

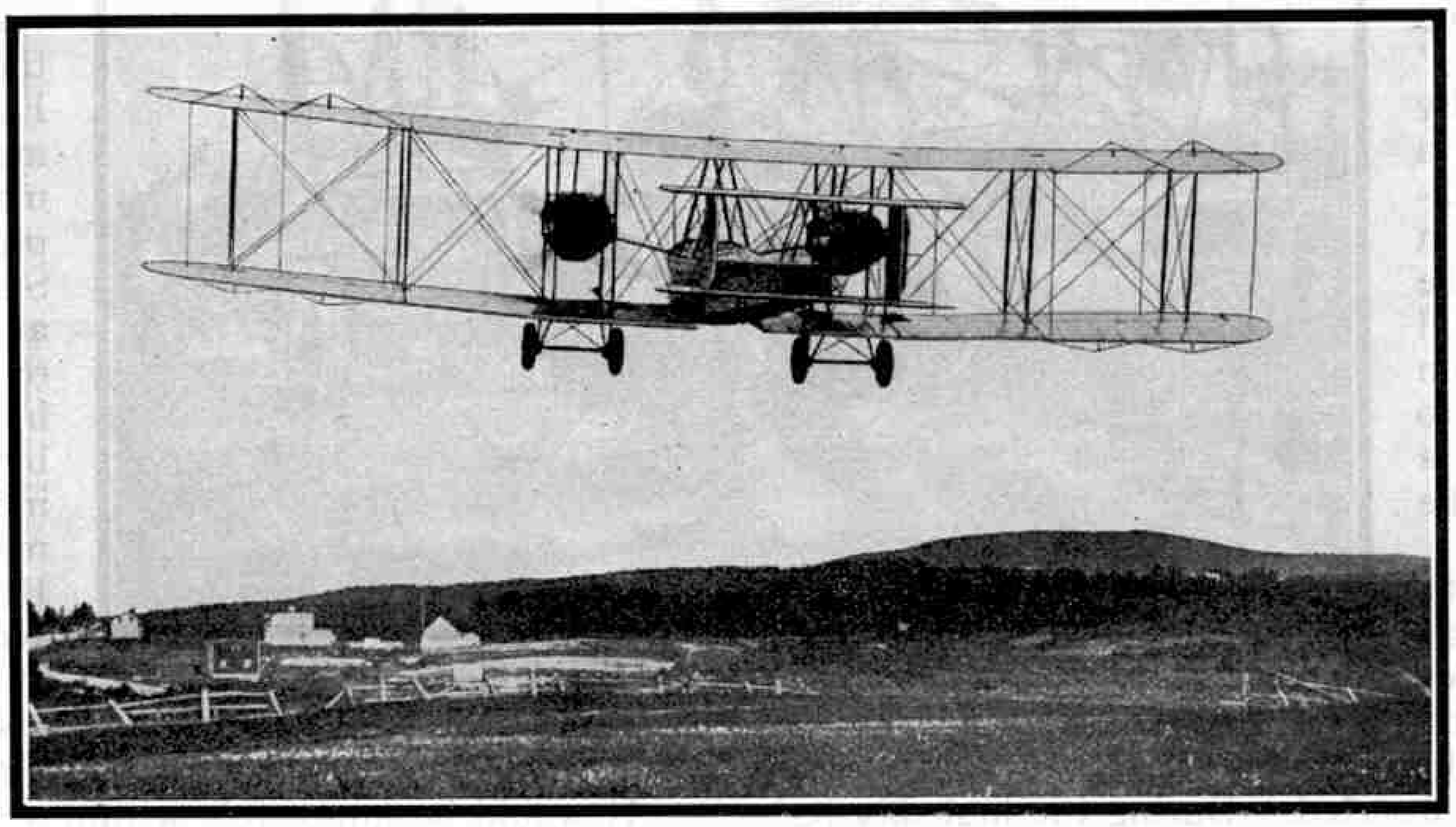
THE Rolls-Royce "Eagle" and "Falcon" engines were produced mainly for military purposes during the Great War. The two engines were designed on somewhat similar lines, and the "Eagle" is, in all essential details, an enlarged "Falcon." These engines performed great feats during the War and at its termination they were made use of in many civilian machines. The more famous of the two was the "Eagle" VIII, with which many great flights have been accomplished, the most noteworthy one undoubtedly being the first non-stop Atlantic flight, made on 14th June, 1919, by Sir John Alcock and Sir A. Whitten Brown.

The aeroplane used in this epoch-making flight was a Vickers "Vimy" of conventional wartime design, equipped with two Rolls-Royce "Eagle" engines, each developing 360 h.p. The flight was made in 15 hours 57 minutes, and it is remarkable that during the 10 years that have elapsed since this initial success, the time then set up has never been surpassed. It is also interesting to note that this non-stop flight across the Atlantic was accomplished by British aviators, on a British aeroplane, driven by British engines The next Atlantic flight did not take place until eight years later.

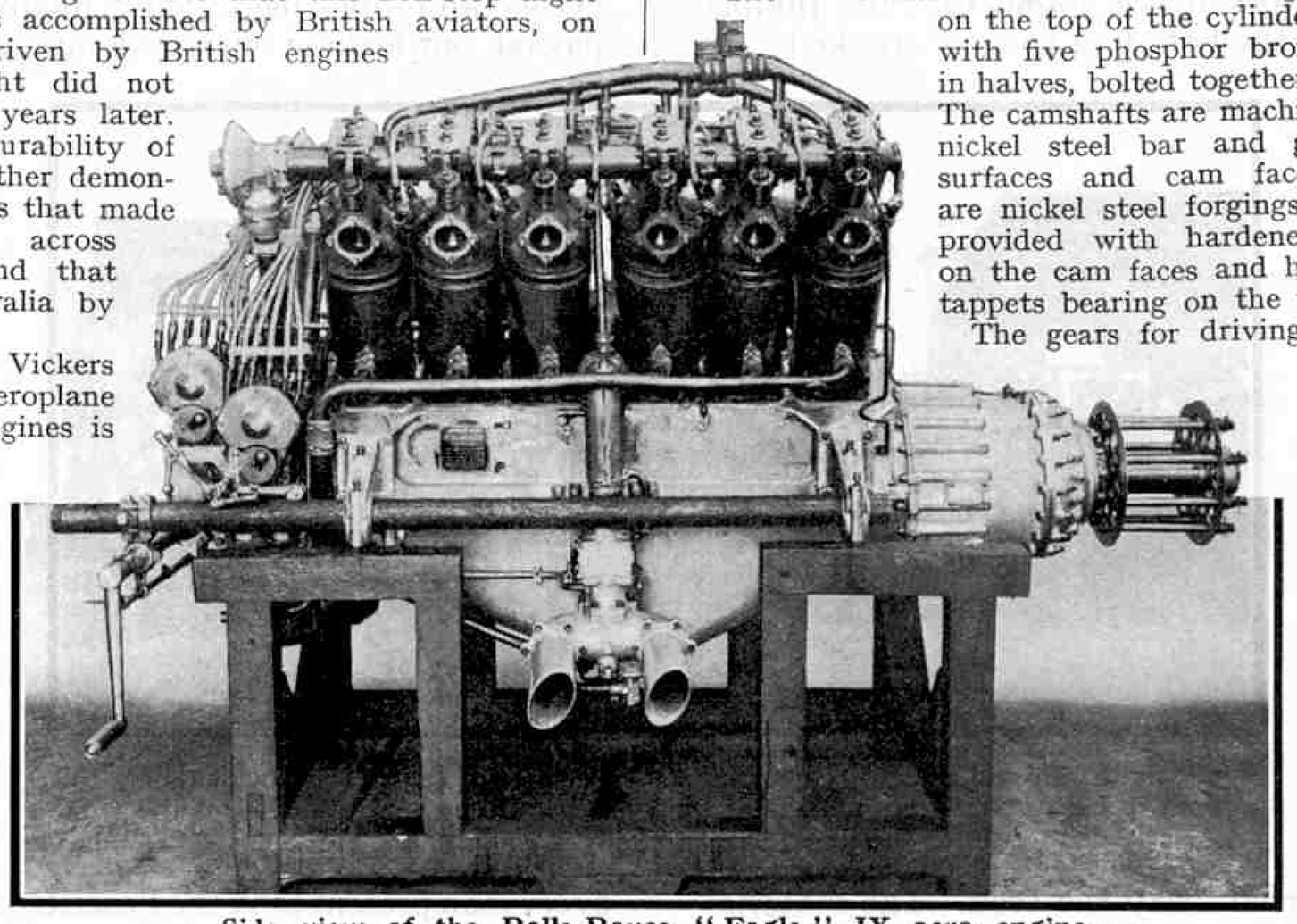
The reliability and durability of the engine has been further demonstrated on such flights as that made by Sacurdura Cabral across the South Atlantic, and that from England to Australia by Sir Ross Smith.

A slightly modified Vickers "Vimy" type of aeroplane fitted with "Eagle" engines is still used for training purposes in the Royal Air Force, while the "Falcon" is the standard engine fitted in the "Bristol" Fighter, an aeroplane that became famous during the Great War.

A wartime model of this type, modernised and fitted with Handley-Page automatic slots, is now extensively used for Army co-operation purposes in India and Iraq.



The start of the first non-stop Atlantic flight, made on 14th June, 1919, by Sir John Alcock and Sir Arthur Whitten Brown. For this and the other photographs illustrating this article we are indebted to Rolls-Royce Ltd.



Side view of the Rolls-Royce "Eagle" IX aero engine

The type of "Eagle" engine now in use for general civil purposes is the "Eagle" IX, which is practically identical with the older type except for the re-arrangement of the carburetters and a number of other slight modifications that have been introduced as the result of greater experience and much patient experiment on the part of the makers.

Both the Rolls-Royce "Eagle" and the "Falcon" engines are of the 12-cylinder, water-cooled "Vee" type, developing a normal crankshaft speed of 1,800 r.p.m. and a maximum crankshaft speed of 2,000 r.p.m. The normal propeller speed of the "Eagle" is 1,080 r.p.m., but the "Falcon" only attains 1,061 r.p.m.

The cylinders are separately mounted on the crankcase in two rows of six at an angle of 60 degrees with each other. They are of built-up all-steel construction, being machined from six per cent. steel forgings with the heads integral with the cylinder barrels. The water jackets are die-pressed sheet steel, acetylene welded at the joints. The valve seatings are machined in the cylinder heads. One inlet and one exhaust valve are provided to each cylinder, operated by overhead camshafts and rockers. The valves are made from special high chromium steel forgings, while the stems work in close-fitting phosphor bronze guides.

The camshafts are enclosed in cast gun-metal cases mounted on the top of the cylinders, and each is provided with five phosphor bronze bearings, which are in halves, bolted together and reamed in position. The camshafts are machined from case hardening nickel steel bar and ground on the bearing surfaces and cam faces. The valve rockers are nickel steel forgings machined all over and provided with hardened steel rollers bearing on the cam faces and hardened steel adjustable tappets bearing on the valve stems.

The gears for driving the camshafts and all auxiliaries are driven from the rear end of the crankshaft through the medium of a spring-controlled friction-damped pinion, thus eliminating crankshaft torsional vibrations from all auxiliary drives. All gears are totally enclosed in a suitable casing and are made from case hardening nickel steel, accurately fitted to shafts running on ball bearings.

The camshafts are driven by means of an inclined tubular driving shaft with bevel gear at the upper and lower ends. Out-of-alignment and expansion effects are allowed for by hardened serrated couplings. The driving shafts are supported in ball bearings, and the whole totally enclosed in tubular casings.

The pistons are of special aluminium alloy and are of the

The Vickers-" Vimy "-Rolls machine in which the first trans-Atlantic flight was made

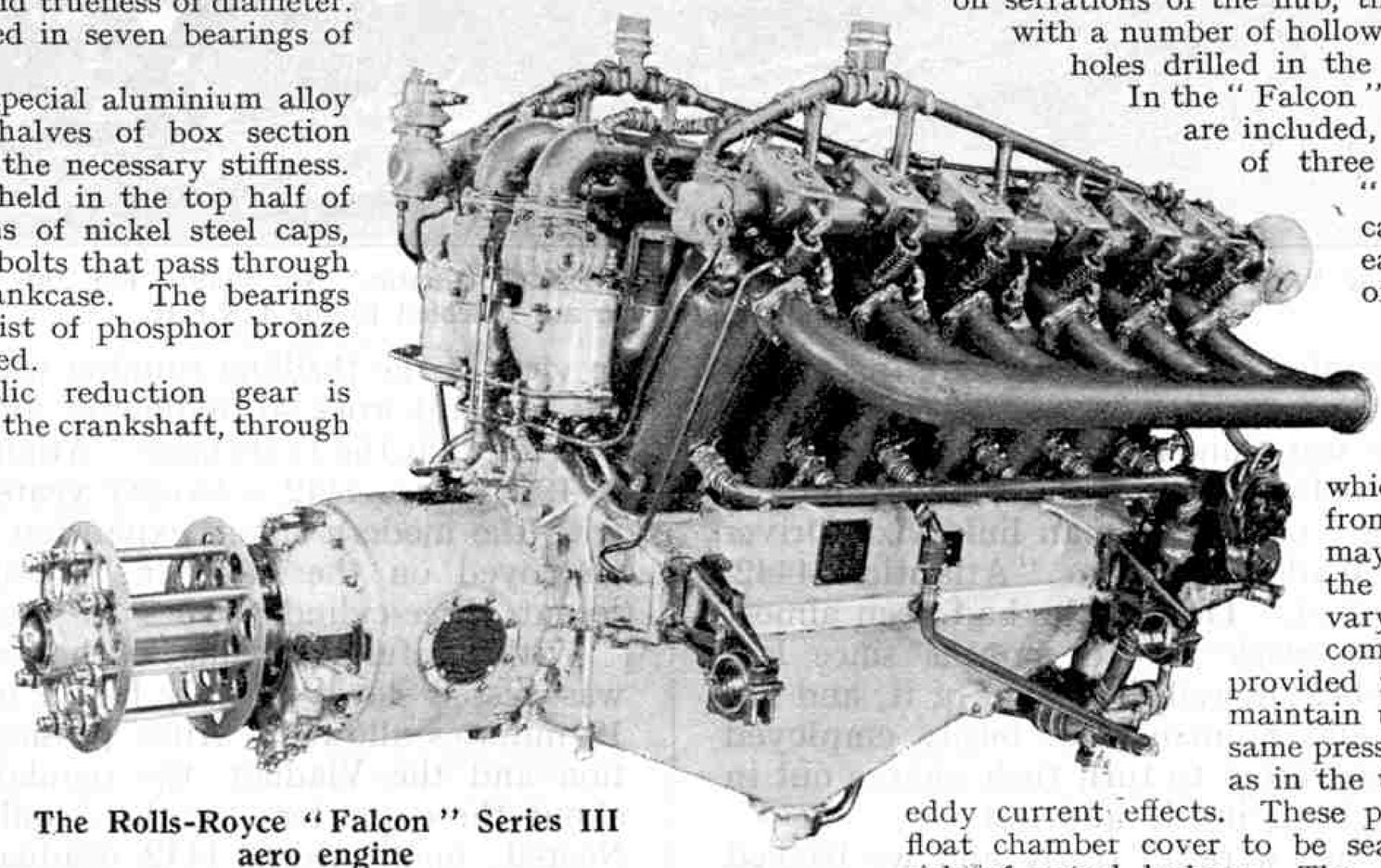
" Zephyr " type. The advantages of this type of piston are that the crown or head is better supported, and the cooling of the piston head is considerably improved. Five piston rings are provided, arranged as four compression rings above the gudgeon pin and one scraper ring below at the base of the " skirt." The compression rings are prevented from slipping round in their grooves by means of stops.

The connecting rods are " H " section of the " articulated " type. The big end of the main rod is white metal lined, the small end being fitted with a phosphor bronze bush. Both ends of the articulated rod are fitted with phosphor bronze bushes, and all bearings are positively lubricated by oil under pressure.

The six-throw crankshaft is machined from a nickel-chrome steel forging, and all the journals and crankpins are bored for lightness and to convey lubricating oil to all bearings and connecting rods. All crankpins and journals are accurately ground to close limits for size and trueness of diameter. The crankshaft is carried in seven bearings of ample proportions.

The crankcase is of special aluminium alloy and is made in two halves of box section suitably ribbed to give the necessary stiffness. The main bearings are held in the top half of the crankcase by means of nickel steel caps, which are held by long bolts that pass through the top half of the crankcase. The bearings are in halves, and consist of phosphor bronze shells, white metal lined.

A compound epicyclic reduction gear is fitted on the front end of the crankshaft, through which is transmitted the drive to the propeller. The annulus driving gear is fixed on the flange of the crankshaft, which rotates the three sets of planet gears round the sunwheel. The latter is the fixed member of the gear, and in the " Eagle " engine is prevented from rotating by means of a friction anchorage in the form of a multi-plate clutch, the plates being anchored to the casing and the sunwheel alternately and pressed together by springs. In the " Falcon " engine the same purpose is served by an Oldham coupling, fastened to the gear casing.



The Rolls-Royce " Falcon " Series III aero engine

The gears and other wearing parts are machined from nickel steel. The planet gears run on ball or roller bearings, and are mounted in nickel steel planet cages bolted to the flange of the propeller shaft. This shaft is made of nickel chrome steel and is supported at its inner end in a bearing mounted in the crankshaft, the front end being carried in a roller bearing of ample proportions. A double-thrust ball bearing is contained in the front end of the epicylic gear casing to take thrusts from the propeller.

The use of an epicyclic reduction gear as arranged in the Rolls-Royce aero engines prevents any reaction from the driving pressures in the teeth of the reduction gears being transmitted to the crankshaft bearings, and it is claimed that an efficiency is obtained that is far greater than can be got with any other type of gear, owing to the fact that the direction of motion is not reversed. Lubrication of all working parts is effected from the engine crankshaft, and the whole gear is totally enclosed in a gear casing carried from the front end of the crankcase.

The propeller hub is a nickel steel forging provided with internal serrations, engaging similar serrations on the propeller shaft. To locate the hub radially and to secure it against any axial movement two opposed tapers are utilised, the one consisting of a split conical phosphor bronze ring on the propeller shaft, and the other of a conical nut on the extremity of the shaft, each engaging conical seats in the hub. The loose flange is fitted on serrations of the hub, the whole being provided with a number of hollow bolts that pass through holes drilled in the propeller.

In the " Falcon " engine four carburetters are included, each supplying a group of three cylinders. In the " Eagle " engine two carburetters are provided, each supplying a group of six cylinders. In both cases the carburetters are of a special Rolls-Royce Claudel Hobson type, fitted with needle valve adjuster by which the flow of petrol from float chamber to jet may be regulated from the pilot's seat to suit varying altitudes. Special compensating passages are provided in the carburetter that maintain under all conditions the same pressure in the float chamber as in the throat, thus neutralising eddy current effects. These passages also enable the float chamber cover to be sealed, thus reducing the risk of petrol leakage. The air intakes of the carburetter project through the cowling of the machine when the engine is installed, and they are arranged to be self-draining. The float feeds in the " Eagle " engine have been modified to enable the engine to function satisfactorily with a head of petrol only eight inches above the centre line of the crankshaft.

The induction pipes are of large diameter, formed with easy bends and water jacketed adjacent to each carburetter. Suitable nozzles are fitted in each of the manifolds for priming purposes.

Four six-terminal high-tension magnetos are fitted and are supported on the auxiliary gear case from which they are driven by means of serrated couplings. Incorporated in the latter is a device for enabling a fine and positive adjustment of the ignition timing to be effected. Two sparking plugs (*Continued on page 874*)

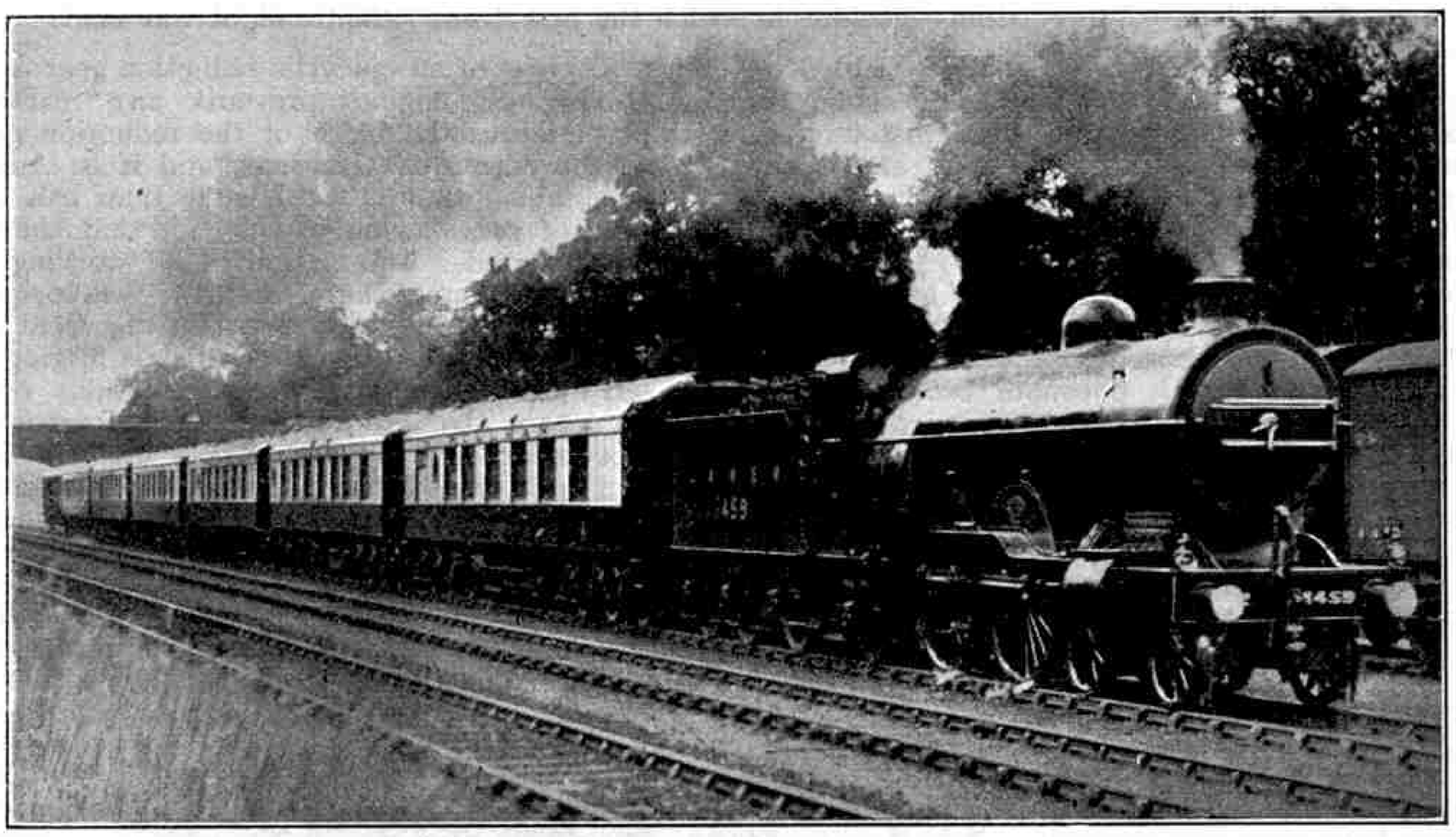
A Trip with the Harrogate Pullman:

On the Footplate with Stop-watch and Note-book

By R. A. H. Weight

THE Pullman expresses between London and the North have, in the comparatively short period of their existence, made a name for themselves as much for their speed, fine locomotive work and punctuality, as for their comfort and service.

As an amateur enthusiast of long experience I was greatly privileged to make a couple of long-distance express footplate trips, and for my return journey to London chose the Harrogate Sunday Pullman, timed to cover the 185¾ miles from Leeds to London non-stop at an average speed of 54 m.p.h. Being familiar with the road and schedule, and accustomed to timing expresses minutely from the train, I was able, despite the unusual surroundings, to take fairly complete records of the running whilst at the same time gaining in a few hours much more practical knowledge than I had perhaps acquired theoretically during years of observation.



The "*Harrogate Pullman Limited*" drawn by L.N.E.R. "Atlantic," No. 4459. For this and the illustration on the opposite page we are indebted to the L.N.E.R.

On a dull, rather wet Sunday afternoon I joined at Copley Hill Shed, near Leeds, one of the famous "human and mechanical trios" of the Pullman link, viz., Driver Sparshott, Fireman Waddingham and "Atlantic" 4442, all of King's Cross Shed. Though she had been almost continuously on fast work for 18 months since last leaving the shops, 4442 showed little sign of it, and her enthusiastic driver and fireman were busily employed in making every preparation to turn their charge out in "apple pie" order, both inside and out.

Soon after 3 p.m. we were all ready and we backed out on to the running lines at Wortley North Junction, and ran tender first through gloomy Holbeck down to Leeds "B" Box, where we shunted to await the arrival of our train from Harrogate. It was brought in by a large N.E. 4–4–0 locomotive a little before time, and as Leeds Central is a terminal station we immediately backed on to the train in readiness for the long, fast run. The load was five Pullmans and a bogie brake van weighing 232 tons tare or about 240 tons with passengers and baggage.

On the "right away" being received, Driver Sparshott applied dry sand and started the engine in full forward gear, Fireman Waddingham assisting with the steam sander on his side for, especially in a drizzle, it is no easy matter to get away and climb the formidable 1 in 80 grade up to Holbeck without slipping, but the task was achieved. On the steep continuing rise of 1 in 100 near Beeston a slack to walking pace was necessary over a bridge under repair, and upon the regulator being reopened the driving wheels momentarily failed to grip the rails and "slipped" violently. Ardsley Tunnel near the top of the bank was entered at 28 m.p.h., and the worst of our initial climbing was at an end. The reversing lever was now brought back to about 30 per cent. cut-off, and it then remained in this position throughout the trip, the engine being driven entirely by the regulator, but always economically. One is apt to forget, in view of the thrilling running which was to follow and the brilliant work so frequently afforded by the type in general, that the Ivatt large "Atlantics" were originated in 1902. No. 4442 is twenty years old and is not fitted with the modern steam expansion valve gear such as is employed on the monster "Pacifics" and the other recent three-cylinder-types in use on the L.N.E.R.

With careful observance of the service slack, Wakefield was passed slowly in only half a minute more than the 19 minutes allowed. After passing West Riding Junction and the Viaduct, the regulator was put over to about three-quarters for the 3 miles 1 in 150 climb to Nostell, upon which 4442 gradually accelerated with remarkable ease. The summit having been passed we worked up to our first burst of high speed on the gradual descent towards Doncaster, a typical regulator opening of between one-quarter or one-third, with light firing and just a little less on the average than the 180 lb. full boiler pressure of steam, giving a gradual acceleration up to a maximum near Hampole of 76 m.p.h. The rain had now stopped, but a strong adverse wind was encountered. A cautious approach to the main line junction and a steady passage through Doncaster, with all signals off, found us already a little before time

despite the delay due to the severe slack at Beeston.

The first 30 miles had taken 40 minutes, but now on the main line for the 156 miles from Doncaster (pass slowly) to King's Cross stop, only 164 minutes are allowed; but, as this narrative will relate, the fast schedule was cut to a remarkable degree!

Throughout to London a very strong side wind was hampering us, but the sky brightened up considerably. With ever-watchful eye and ear, Driver Sparshott controlled his beloved engine in masterly fashion. Fireman Waddingham skilfully fed the fire at suitable intervals with excellent Yorkshire coal, swept the footplate clear of dust, and kept on the alert by instinct to look for signals which are so situated as to be observable earlier from his side than from the driver's. He also watched the working of the all-important injectors, and put the left-hand (exhaust steam) one into operation whenever the driver shut the regulator. When passing through tunnels Waddingham elected to spray the coal with water fed into a hose pipe from the injector in order to keep down the dust. The combined effect of the inky blackness, the glare of the fire, the noise of the engine's exerted power, the smoke and some of the spray from the hose pipe were weird in the extreme and might have been even terrifying to a less conversant guest!

The interior of the first-class Pullman car "Iolanthe"

We picked up sufficient water at Scrooby by lowering the scoop for not more than half the extent of the troughs, the fireman assisting the driver to raise the scoop by a hearty push at the lever affixed to the front of the tender.

We had been travelling at more than 60 m.p.h. on the level when we passed through Retford and the engine rolled somewhat over the points and crossing tracks. The regulator opening was increased and a liberal ration of coal supplied to the capacious firebox for the 1 in 178 rise to Markham Box, 5 miles beyond Retford. A minimum speed of 56 was recorded by my stop-watch on this ascent, and on the run down to the Trent level our gay steed travelled as fast as 74 m.p.h. on a very small regulator opening. The complexities of Newark shook one up a bit, but on passing that town we had run so well as to be already $3\frac{3}{4}$ minutes ahead of time and the $35\frac{3}{4}$ miles from Doncaster to Newark had only occupied $33\frac{1}{4}$ minutes.

Very shortly afterwards a distant signal beneath an advance starter was sighted at danger—at the earliest possible second, of course. Instantaneously, the driver closed the regulator, and applied the brake sufficiently to give a steady stop at the home signal if necessary. The fireman opened the exhaust injector, and tugged at the whistle which proclaimed our disapproval in shrill tones. The home signal dropped as we drew up to it, but only to allow us to run forward to a dead stand at the "starter."

The diminutive signal-box concerned was a level-crossing post named Barnby.

We actually stood for $1\frac{1}{2}$ min., but the loss of time involved was—I am sure—5 min., as the speed here would normally be over 60 m.p.h., and adverse gradients lay ahead.

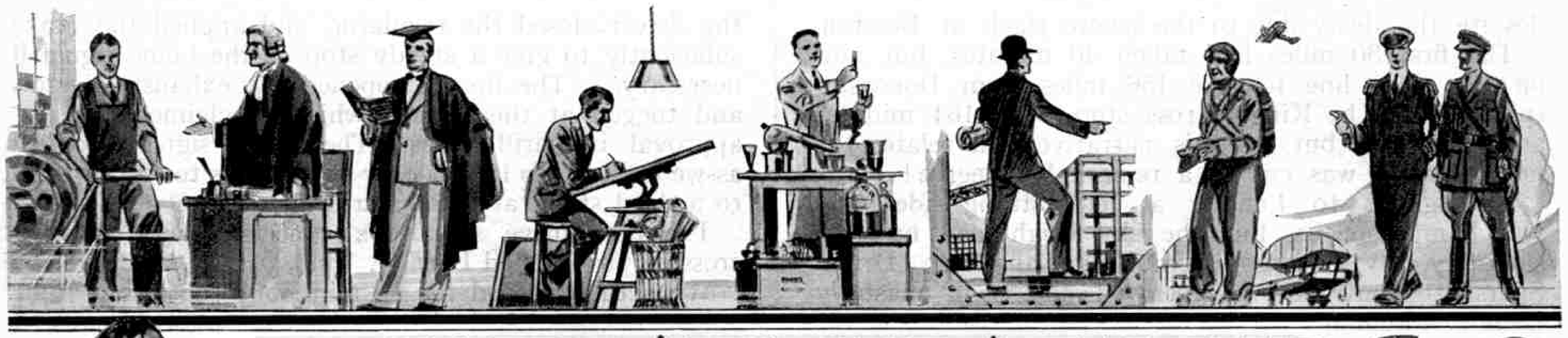
When passing Claypole, we saw, shunted into the siding, a special train conveying a crane from some engineering repair work, and this was the cause of our stop at Barnby. We made some not altogether complimentary signs to the driver of the G.C. type 2–8–0, but he did not appear at all disconcerted at having been the cause of stopping a famous "Luxury Flier!"

Despite the hindrance, Grantham, on a long stretch of up grades, was passed $\frac{1}{4}$ min. early, but a further set back occurred here, as the south signal box was closed, and the distant signal appertaining thereto was left at danger, as is customary on the Sabbath. The Pullman is the only regular up train on that day not booked to stop at Grantham, and it must check its speed to obey the warning of the distant arm, so instead of passing the station at well over 50 m.p.h., we eased down to less than 30. Getting going again on the continuing 1/198 $5\frac{1}{2}$-mile rise up to Stoke summit, 4442 worked up to 52 m.p.h., and then on the famous descent of the Stoke Bank came a thrilling flight, in the course of which a maximum speed of no less than 85 m.p.h. was sustained at Essendine, and 15 miles were run in $11\frac{1}{2}$ min.!

At 85 m.p.h., the "riding" of the engine was as steady as at 60! Indeed, the engine ran remarkably comfortably over the perfect track throughout, and only produced a mild sort of "ship at sea" sensation when passing over complicated junctions. The look-out ahead through the windows is excellent, and the viewing of the road and the side of the engine from the novel vantage point of the footplate proved most fascinating to the writer.

Speed was still in the neighbourhood of 70 m.p.h. when Werrington troughs and junction were passed, but I knew by the driver's face that all was not perfect! The water level in the boiler,

(Continued on page 857)



WHAT SHALL I BE ?

IN the preliminary article in this series, published last month, we surveyed briefly the whole field of engineering. We now propose to deal in turn with each of the many branches of this profession in order to show exactly how a boy may begin his career in the one he has chosen.

The division that first claims attention is Mechanical Engineering. This may be described as fundamental, for it is the mechanical engineer who designs and makes the machinery and equipment required by those concerned in other branches of engineering.

As is the case in other trades and professions, there are various grades open to those desirous of becoming mechanical engineers, and correspondingly there are several methods of entry. The most usual course is to take up an apprenticeship. Most large mechanical engineering firms employ two grades of apprentices—trade and technical. A trade apprentice commences work on leaving the elementary school, or soon afterwards, the usual age limit being 14 to 18. A small premium may have to be paid, but this is not always demanded; and indentures must be signed for a period of five years, or until the apprentice is 21 years of age, whichever is the longer period.

It is at this point in his career that the prospective engineer first realises the seriousness of the step he is taking. By accepting the indentures he literally "burns his boats" behind him, for although he may be dismissed if unsuitable, the form he signs usually contains clauses that impose penalties in the event of his desiring to leave of his own accord.

A trade apprentice usually is a relative of someone already employed by the firm. It certain cases other boys attain the same position after serving as general utility workers for about two years. In order to be deemed worthy of apprenticeship a boy in this position must attract the notice of his foreman by showing willingness and aptitude.

One drawback to entering the engineering profession in this manner is that the trade apprentice usually is required to choose the shop in which he wishes to work, and in this he probably will remain during the whole of his training. Thus his opportunities are limited and, generally speaking, the best prospect he has is that of rising to such a position as inspector or shop foreman. This is not invariably the case, however. Many engineering firms do not employ purely trade apprentices, and the fortunate boys who get their training in the works of such firms may be allowed to pass through all the shops and thus gain a wide and valuable experience.

The second grade of apprentice—the technical apprentice—comes to his work with a better education and therefore with better prospects. He is recruited from technical, secondary and public schools, and must be up to Matriculation standard. The age at which he enters the works is between 16 and 18 years. In some cases premiums varying from £50 to £200, and even as much as £400, are required from him, but the modern tendency is to dispense entirely with premiums.

Technical apprentices receive a wider training than trade apprentices. They usually spend a certain length of time in each of the shops in the works, including a short period in the drawing office, where they become familiar with problems of design and the methods to be followed in putting new ideas into practice. This system of training equips them for more responsible and remunerative positions than those open to trade apprentices, whose experience is more limited.

Both types of apprentices are required to further their technical knowledge by attending evening classes at an approved technical school. There are very few towns in which competent instruction in engineering, machine drawing, mathematics and science cannot be obtained at moderate charges, the cost being paid by the student himself. The complete course usually requires attendance for three nights a week for a period of five or six years, and should enable a reasonably industrious apprentice to obtain his National Higher Certificate.

The National Higher Certificate referred to is a diploma in mechanical engineering that is issued jointly by the Board of Education and the Institution of Mechanical Engineers. The possession of one of these certificates is a guarantee that the owner has received a sound training in engineering, for the final examination is largely carried out by assessors appointed by the Institution. For an apprentice who has passed the Matriculation examination, or its equivalent, before entering upon his career, the length of the course may be reduced by one year.

The wages of trade and technical apprentices vary considerably in different parts of the country, and also to some extent in different trades in those cases where an all-round engineering training is not given. Annual increases on a definite scale are customary. A boy of 16 could not expect to receive more than from 7/6 to 10/- per week, but in the last year of his training an apprentice draws from 25/- to 30/-.

In many cases pay depends on behaviour and ability. For instance, the apprentices of one well-known firm, at the end of their first year, are graded into three classes in accordance with marks awarded at an annual works examination that follows the lines of the engineering courses arranged at the local technical school. Those graded as first-class receive higher pay throughout the rest of their career—in the final year the increase is 3/- per week—while the wages of those who are regarded as only third-class are reduced below the ordinary rate. Under the scheme of this firm industry and efficiency are rewarded by annual prizes and small increases in weekly pay.

Although at first sight these wages may appear low, it should be remembered that the apprentice is being taught a trade and given valuable experience. If he conducts himself well and makes the best use of his opportunities, his weekly earnings are increased immediately on the conclusion of his apprenticeship; and in 10 years' time he probably will be earning a wage of £5 or more.

Where the necessary expense can be afforded, by far the best plan to be followed by a boy who wishes to become a really competent all-round mechanical engineer is to undergo a course of training at a University or Technical College. Most of these institutions now offer splendid facilities for this purpose, and care is taken to include a sufficient proportion of practical works training. This is ensured by co-operation with local engineering firms, and usually the heads of these firms are members of the Board or Committee under whose general advice the details of the courses are arranged. In most cases firms associated in this manner with the Engineering Department of a University not only give opportunities for workshop practice, but on the completion of their training admit students on specially favourable terms.

The engineering courses arranged by a University or Technical

"If in doubt—write to the M.M."

This series of articles will cover the whole field of Engineering and subsequent articles will deal in turn with each of the various branches. It is hoped that sufficient information will be provided to enable readers who are interested to make an intelligent choice of the career that they intend to follow.

The Editor takes this opportunity of reminding readers that he is anxious to help with advice wherever possible. He welcomes letters from any readers in difficulty, and his knowledge and experience are always at their disposal.

College thus may be divided into two sections—the academic and the practical. The chief purpose of the lectures and laboratory courses arranged at the University itself is to enable the student to qualify for a degree in engineering, the first step of course, being the Matriculation Examination, which should be passed by all students who embark on an engineering career in this manner. These courses include mathematics and science in order to give the student a thorough grasp of the fundamental principles of engineering.

Practical experience may be acquired in various ways. As a rule, University vacations are long and the keen student may use this time for the purpose. It is now more usual to make definite arrangements in this respect, and what has been described as " sandwich " courses are arranged by practically all Universities and technical colleges. In certain Universities, for instance, the session covers the winter months and the six months of summer time are spent in works.

An admirable method of training is that arranged by the University of Bristol in conjunction with well-known engineering firms. The course begins in the Engineering Department of the University, which the student attends for 10 months. He then spends 14 months in an engineering works, after which he returns to the University with sufficient experience to enable him to obtain a better grasp of the theoretical and scientific side of his chosen profession. Two periods of 10 months each are then passed in the University, separated by a spell of two months in the works, and the training is finished off with a further 14 months' practical work. Thus the student spends 30 months in his university studies and an equal time as a practical engineer. In engaging members of their staffs many local firms give preference to students who have completed the full " sandwich " course.

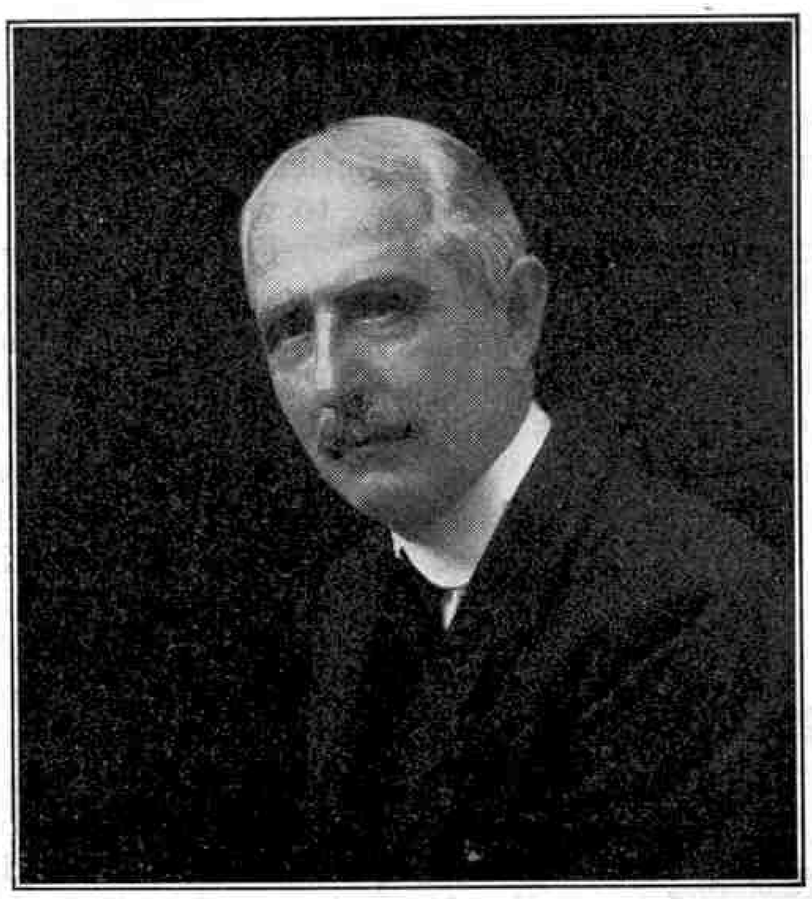
Would-be engineers who wish to enter the profession through the medium of a University training of the type outlined should apply for information to the Dean of the Faculty of Engineering of the institution that is most conveniently situated, or which for any other reason appears to be most suitable. If there is any doubt on this point inquiries may be made in several quarters and the relative merits, from the student's point of view, of various institutions carefully compared.

On completion of their course University-trained apprentices are eligible for appointments as Junior Engineers at salaries of about £200 per annum. Later they may rise to posts carrying salaries of £400 to £700, and eventually may become Heads of Departments or Chief Engineers, when they may receive £1,000 or more a year.

Every engineer who has any ambition to take a place in the higher ranks of the profession should qualify for membership of the Institution of Mechanical Engineers. The first step towards this end is to become a Student of the Institution. This class of membership is open to apprentices or pupils in works, and to students in engineering colleges, who have passed a University Matriculation examination, or its equivalent, and are between the ages of 16 and 25. At the age of 21 the Student becomes a Graduate, the transference to this class being obtained on passing an examination held for the purpose of obtaining a recognised engineering degree. Engineers in training who belong to one of these classes of the Institution have valuable privileges, full details of which may be obtained from the Secretary of the Institution of Mechanical Engineers, Storey's Gate, St. James's Park, London, S.W.1.

The general prospects in Mechanical Engineering were referred to last month, but we must point out that the profession is steadily gaining in importance, and there is always room in it for industrious and patient men. Any boy with ability and perseverance who has received a thorough training may look forward to a successful career.

FAMOUS ENGINEERS—1



H. S. Hele-Shaw, D.Sc., F.R.S., M.I.C.E., M.I.M.E., one of the world's famous engineers. At the age of 22 he was senior Whitworth Scholar of the Institute of Civil Engineers. He studied at Bristol University and became its first Professor of Engineering. Later he became first Professor of Engineering at Liverpool University, and was President in turn of the Institute of Mechanical Engineers and the Institute of Automobile Engineers. He is the originator of many valuable inventions, these including the Hele-Shaw clutch and the Gloster Hele-Shaw variable pitch air-screw

A Trip with the Harrogate Pullman—(*Continued from page 855*)

which had been so well maintained up to this point, was falling somewhat as a result of the right hand (live steam) injector having ceased to function. Now, we were approaching Peterborough, where an application of the brake was gradually made to bring the speed down to about 12 m.p.h. in order to conform to the severe speed restriction through the north station, which we passed with all signals clear, 5¾ min. before time, or in the remarkable time of 25½ min. from passing Grantham—29 miles away!

We gathered speed again somewhat gradually, compared with the superlative standard of running maintained on this memorable trip, for at favourable moments, the driver and fireman were endeavouring to coax the refractory injector back to activity. It had probably become choked with coal dust, for near Holme, when we were travelling at 65 m.p.h. over the flat fen country, they were rewarded by the gurgling sounds which indicated that the trouble had been eradicated; the water in the gauge rose, and we breasted Ripton Summit at 51½ m.p.h. with all correct once more.

Huntingdon was passed 6½ min. before booked time, at a speed of 67, then shortly came signals at danger again; a long crawl past home and starting signals at Offord almost culminating in a dead stand at the advance starter which only dropped when we had nearly stopped. This final delay cost 4 min., and was incurred probably because we had been gaining so much on schedule, and had " caught up " a slow train, which we subsequently passed. From the point where full speed was reattained, an average of over 60 m.p.h. was maintained continuously, until we were well on the long 1 in 200 ascent from Arlesley towards Stevenage. Hitchin was passed 2½ min. early at 53 m.p.h., and the absolute minimum near Stevenage was 49 m.p.h.; the engine being worked quite easily all along here. From Knebworth, the final speeds were 68 m.p.h. at Welwyn, 73 at Hatfield, no less than 60 at Potters Bar, 70 at New Barnet, 74 at Wood Green (past my house), and 60 at Finsbury Park, with steam shut off. A careful run down through the tunnels, wherein it was much more comfortable on the footplate than on the outward journey when the regulator was full open, brought us triumphantly into the beloved but ugly main arrival platform at King's Cross at 7.9 p.m., or six min. early, notwithstanding no less than 12 min. delays!

The actual time for the 185¾ miles from Leeds to London was 199 min., which, in itself, was indeed *good enough*, but careful calculation and comparison with unchecked runs over the same stretches gives the following remarkable net running times, allowing for the delays:—

	Miles.	Min.	Average in m.p.h.
Leeds to London	186	187	59.9
Doncaster to London	156	148½	63.2
Grantham to London	105½	99¾	

and so on!

After the revelation of such figures, it only remains to be said that, on arrival, 4442 was in perfect condition; the fuel and oil consumption had not been at all excessive, and that I was sorry to part from that wondrous locomotive and her admirable crew, who had treated me so kindly.

While expressing hearty congratulations to Driver Sparshott and Fireman Waddingham, one salutes the memory of Mr. Ivatt—the designer of the world-famous and eminently successful G.N. Atlantic type—and also one includes the officers and staff concerned at King's Cross shed.

One of the greatest secrets of success on the footplate—as in many other phases of railway operation—is mutual co-operation, and it was most inspiring to watch, on both my journeys, the quiet, efficient, and enthusiastic manner in which drivers and firemen worked together so skilfully to produce the best results.

[We have to thank the Editor of the London and North Eastern Railway Magazine for permission to reprint this interesting article.—EDITOR].

New Meccano Models

4-2-0 Locomotive—Horse Rake—Catamaran—Flyboats—Single-Acting Engine, etc.

THIS month we illustrate and describe eight original models that should suit the requirements of those model-builders who are not the lucky possessors of large outfits. Each of these models can be built from the parts contained in a No. 1 Outfit, but there is ample scope for the constructor who possesses additional parts to enlarge upon the designs shown, and some very excellent effects can be achieved in this manner.

"Single Wheeler" Locomotive

The model 4–2–0 engine shown in Fig. 1 has been designed within the limits of a No. 1 Outfit, this accounting for its somewhat "skeleton" appearance. If additional parts are available, however, there is no reason why the constructor should not fill in the boiler, firebox and cab, when a considerably improved appearance will result.

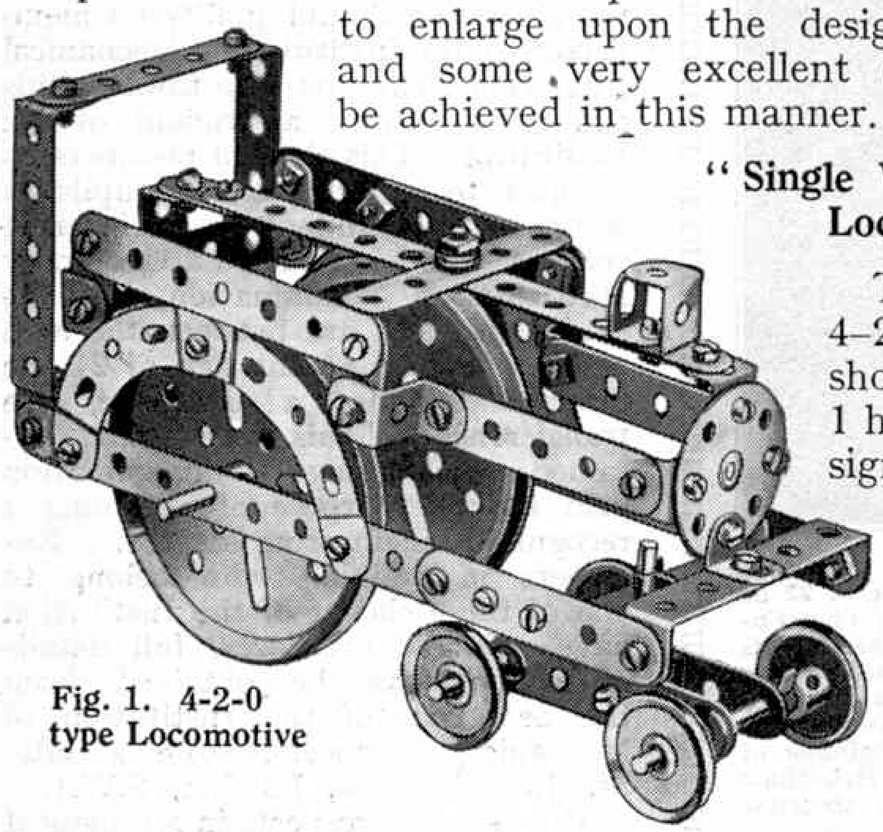


Fig. 1. 4-2-0 type Locomotive

The frame of the engine consists of a pair of $5\frac{1}{2}$" Strips extended to 7" by $2\frac{1}{2}$" Strips and spaced apart at each end by $2\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strips. A Bush Wheel is secured to the front Angle Strip by means of an Angle Bracket and carries further Brackets to which $2\frac{1}{2}$" Strips are secured to form the boiler. The firebox is represented by Strips held in position by Flat and Reversed Angle Brackets. $2\frac{1}{2}$" Curved Strips form the "wheel splashers," while the "cab" is composed of Double Angle Strips and a $2\frac{1}{2}$" Strip.

The following parts will be required in the construction of the model: 3 of No. 2; 1 of No. 3; 9 of No. 5; 5 of No. 10; 2 of No. 11; 6 of No. 12; 3 of No. 16; 1 of No. 18a; 2 of No. 19b; 4 of No. 22; 1 of No. 24; 8 of No. 35; 36 of No. 37; 6 of No. 37a; 6 of No. 38; 1 of No. 48; 6 of No. 48a; 4 of No. 90a; 6 of No. 111c; 2 of No. 125.

Power Driven Vertical Drill

The model drilling machine shown in Fig. 2 incorporates a hand control drill feed mechanism and adjustable work table.

A 3" Pulley forms the base of the model and carries in its boss a $3\frac{1}{2}$" Axle Rod, to the top of which a Bush Wheel is secured. Two $2\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strips are bolted to the Bush Wheel, their upper ends being secured to a Flat Trunnion. A $1\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strip is bolted between the two Strips and carries an Angle Bracket to which the $3\frac{1}{2}$" Strip 2 is lock-nutted.

The work-table consists of a Flat Trunnion secured by means of an Angle Bracket to the boss of a 1" Pulley. The height of the table can be adjusted by sliding the Pulley up or down the Axle Rod and locking it in position by the $\frac{3}{8}$" Bolt inserted in the boss of the Pulley Wheel.

The flywheel, which consists of a 3" Pulley 1, is secured on a $1\frac{1}{2}$" Rod journalled in a Cranked Bent Strip. Cord is wound round this Rod, passed over two 1" Pulleys 3, which revolve idly on a 2" Rod journalled in a Double Bracket, and finally is passed round the Pulley secured to the top of the Rod 4 which forms the drill spindle.

The vertical movement of the drill is controlled by the Strip 2 which bears against two Washers that are held in position on the Rod 4 by Spring Clips. By depressing the Strip 2 the drill can thus be fed into the "work" on the work table.

In order to construct the Drill the following parts will be required: 1 of No. 3; 2 of No. 5; 1 of No. 11; 2 of No. 12; 2 of No. 16; 2 of No. 18a; 2 of No. 19b; 4 of No. 22; 1 of No. 24; 4 of No. 35; 16 of No. 37; 1 of No. 37a; 1 of No. 44; 1 of No. 48; 2 of No. 48a; 1 of No. 111c; 2 of No. 126a.

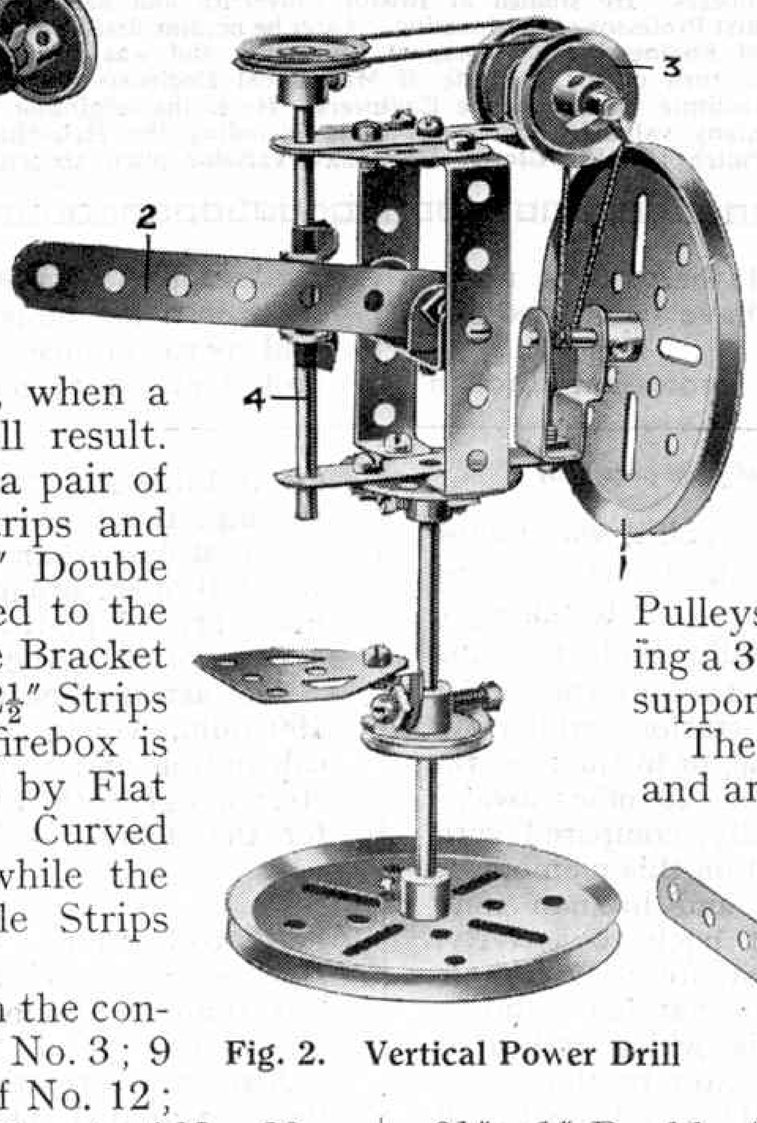


Fig. 2. Vertical Power Drill

Horse-drawn Hay Rake

The model shown in Fig. 3 represents a well-known piece of agricultural equipment—the hay rake. The Meccano Rake consists of four $2\frac{1}{2}$" Curved Strips secured by means of Pulleys and Spring Clips on an Axle Rod carrying a 3" Pulley Wheel at either end. Additional support for the Strips is provided by the Rods 2.

The "shafts" are composed of $5\frac{1}{2}$" Strips and are held at the correct distance apart by a $2\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strip. A $2\frac{1}{2}$" Strip 1 forms the "trip lever" and is connected by means of the Strip 3 to the Rod 2. On drawing the Strip 1 forward the rake is raised, thus releasing any material that has been collected.

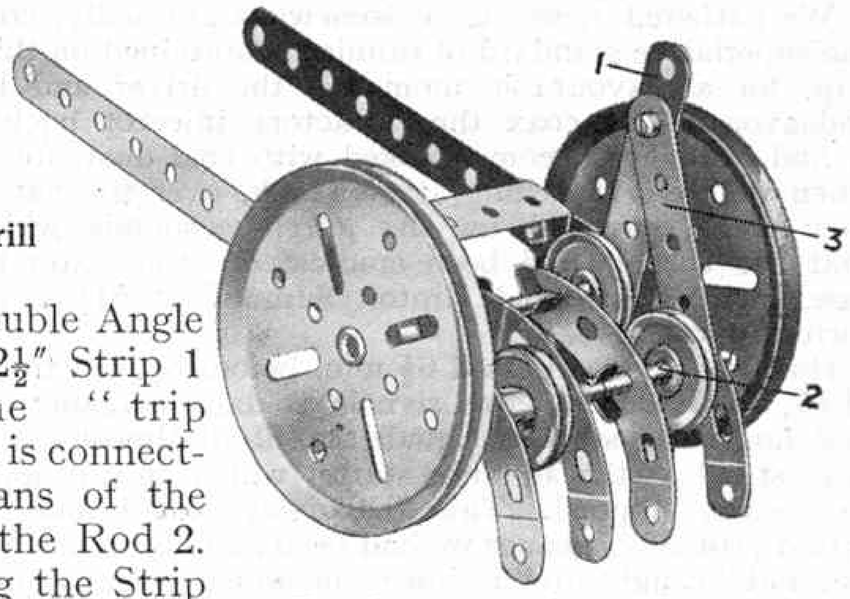


Fig. 3. Horse-drawn Hay Rake

As will be seen from the following list very few parts are required to build the model: 2 of No. 2; 2 of No. 5; 1 of No. 16; 2 of No. 18a; 2 of No. 19b; 4 of No. 22; 7 of No. 35; 3 of No. 37; 1 of No. 48a; 4 of No. 90a.

Catamaran or Outrigger Canoe

The model shown in Fig. 4 represents a primitive form of sailing vessel employed by native fishermen in the Indian Ocean.

The actual craft often comprises nothing more than a hollowed tree trunk fitted with a sail composed of grass matting! A long wooden float is generally attached to one side of the hull to provide the necessary stability in rough seas. This is known as an "outrigger."

The hull of the model is composed of four $12\frac{1}{2}''$ Strips, which are bolted to Flat Brackets at each end. Two $5\frac{1}{2}''$ Strips bolted together represent the mast, which is secured to the hull by a Double Bracket and carries two horizontal $5\frac{1}{2}''$ Strips to represent the "yards" that support the "sail."

The "outrigger" consists of two $5\frac{1}{2}''$ Strips overlapped and bolted together. It is secured to the hull by $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips.

The parts required for the model are: 4 of No. 1; 6 of No. 2; 2 of No. 10; 1 of No. 11; 17 of No. 37; 2 of No. 48a. Short piece of cord.

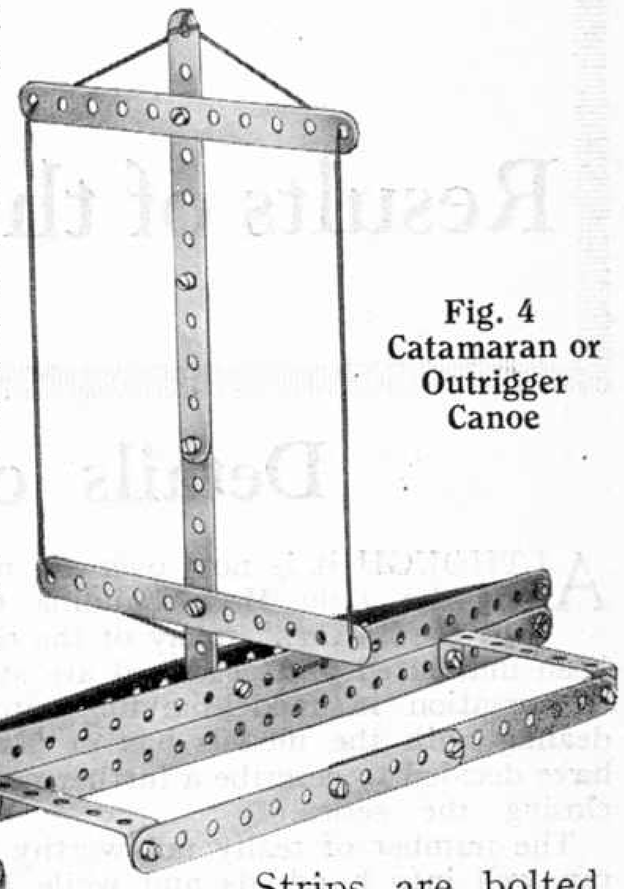


Fig. 4
Catamaran or Outrigger Canoe

A Simple Meccano Ship

A sailing vessel of a slightly more orthodox pattern to the one just described is shown in Fig. 5!

Commence the construction of the model by assembling the keel, which consists of two $12\frac{1}{2}''$ Strips bolted at the stern to a Double Bracket and at the prow to a $2\frac{1}{2}''$ Strip. Two $2\frac{1}{2}''$ Curved Strips are bolted to the Double Bracket and a $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip is bolted across their upper ends. To this, two $12\frac{1}{2}''$ Strips are secured and spaced apart by a $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate. They are bolted to the $2\frac{1}{2}''$ Strips at the bows. The mast consists of two $5\frac{1}{2}''$ Strips secured to a Double Bracket which, in turn, is bolted to two Reversed Angle Brackets attached to the Flanged Plate.

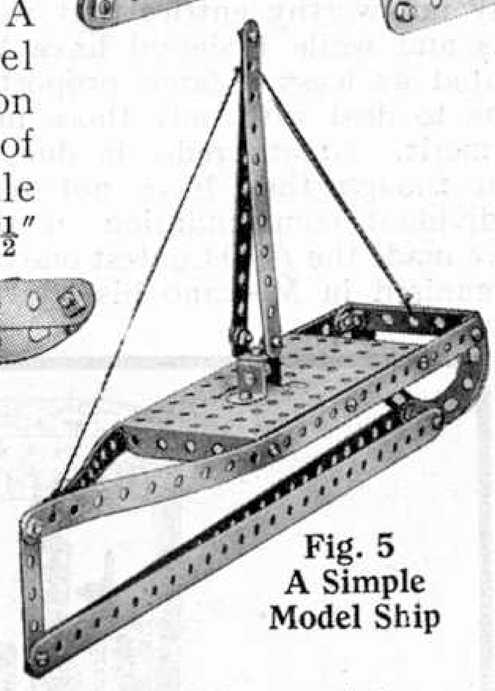


Fig. 5
A Simple Model Ship

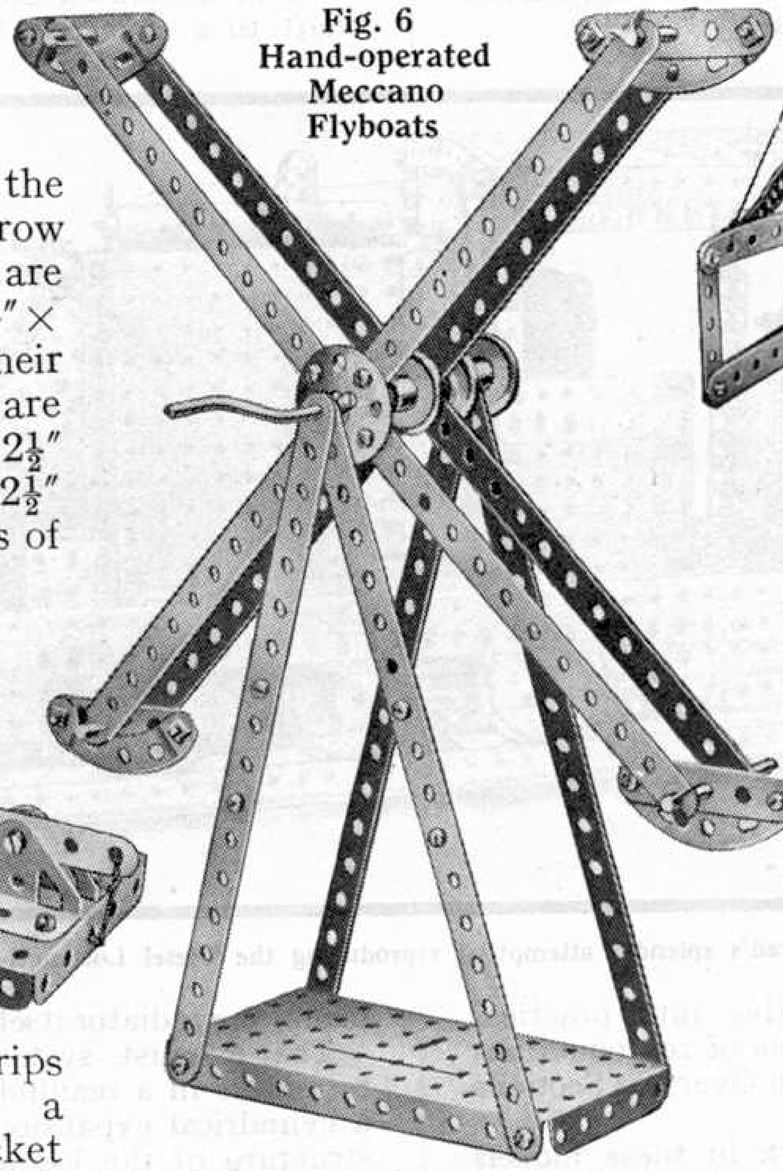


Fig. 6
Hand-operated Meccano Flyboats

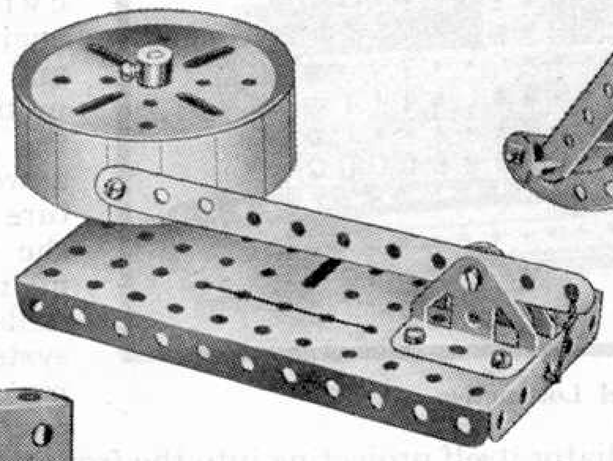


Fig. 7
Seismograph, or Vibration Recorder

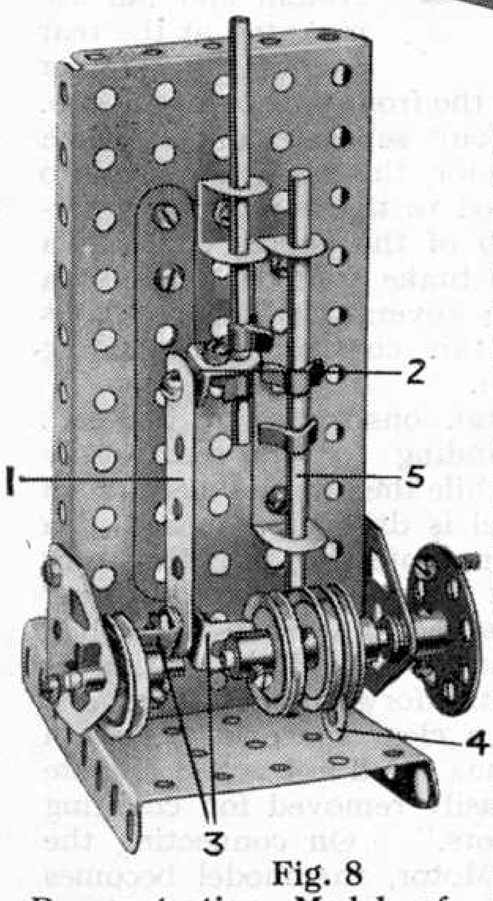


Fig. 8
Demonstration Model of single cylinder single-acting Engine

The parts needed in the construction of the model are: 4 of No. 1; 2 of No. 2; 1 of No. 5; 2 of No. 11; 21 of No. 37; 1 of No. 48a; 1 of No. 52; 2 of No. 90a; 2 of No. 125.

Hand Operated Flyboats

The model Flyboats shown in Fig. 6 will probably bring back pleasant memories to many Meccano boys who spent their holidays at a seaside resort, and not a little of the time in being whirled round and round in one of these machines!

The supporting standards of the model should be built first. These consist of four $5\frac{1}{2}''$ Strips extended to 9" by means of four further Strips overlapped and bolted to them. The built-up Strips are secured to a $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate, forming the base of the model, in such a position that their upper ends form journals for a Crank Handle. A Bush Wheel is secured on the shaft of the Handle and two $12\frac{1}{2}''$ Strips are bolted to it in the form of a cross. Two further Strips are clamped in position by 1" Pulleys. The ends of the Strips are connected by 2" Axle Rods supporting the "boats" which consist of $2\frac{1}{2}''$ Strips to which $2\frac{1}{2}''$ Curved Strips are bolted.

The model comprises the following parts: 4 of No. 1; 8 of No. 2; 4 of No. 5; 2 of No. 17; 2 of No. 18a; 1 of No. 19s; 4 of No. 22; 1 of No. 24; 8 of No. 35; 24 of No. 37; 1 of No. 52; 4 of No. 90a.

A Meccano Seismograph

In Fig. 7 is illustrated a model of a seismograph, or vibration recorder. The model could perhaps be used to record local shocks, but its value as a detector of earth tremors is very uncertain!

A strip of paper suitably graduated is gummed around the edges of two 3" Pulley Wheels to form the recording drum, the Pulleys being mounted on a Rod journalled in a Double Bracket bolted to the side flange of a $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate, which forms the base of the model; two Trunnions are also secured to this Plate.

A $5\frac{1}{2}''$ Strip carries the recording "stylo" (a Meccano Bolt) and is pivoted on a $\frac{3}{8}''$ Bolt journalled in the Trunnions. The other end of this Strip is connected to the base plate by a short length of elastic. Shocks transmitted to the base plate of the instrument cause the pivoted arm to oscillate, the vibration being magnified considerably at the end carrying the stylo. The vibrations are consequently recorded on the slowly rotating drum in the form of an irregular wavy line.

The Meccano Seismograph comprises the following parts: 1 of No. 2; 1 of No. 11; 1 of No. 17; 2 of No. 19b; 6 of No. 37; 1 of No. 37a; 1 of No. 52; 1 of No. 111c; 2 of No. 126; and a (*Continued on page 861*)

Final Comments on Results of the £100 Model-Building Competition

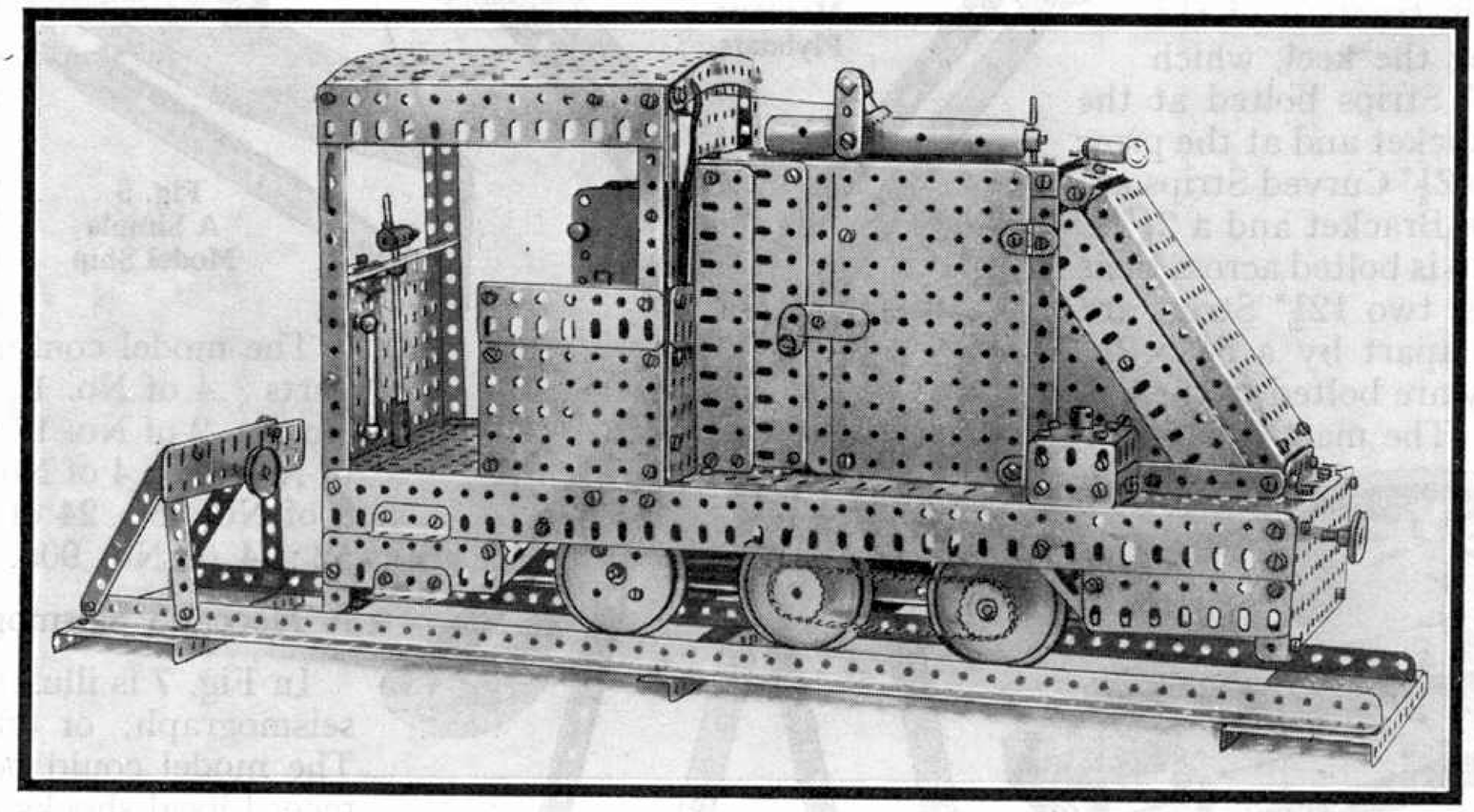
By Frank Hornby

Details of Prize-Winning Diesel Locomotives

ALTHOUGH it is now over six months since the first results of the £100 Model-building Competition were published in the "*M.M.*," many of the outstanding models that have been illustrated and described are still one of the chief topics of conversation in model-building circles. The series of articles dealing with the models has in fact proved so popular that I have decided to describe a further number of models before finally closing the series.

The number of really noteworthy entries that were submitted ran well into hundreds and while I should have liked to have mentioned and illustrated at least a large proportion of these, space has permitted me to deal with only those models of particularly outstanding merit. Great credit is due, however, to all prize-winners, even though they have not been fortunate enough to receive individual commendation in these articles, for collectively they have made the £100 Contest one of the greatest that has ever been organised in Meccano history!

The models illustrated this month are all of one subject, namely the Kerr Stuart Diesel Locomotive. This engine, which has been called the "Locomotive of the Future," was fully described in the January, 1929 "*M.M.*" and has aroused wide-spread attention from engineers in all parts of the country. It was only natural therefore that Meccano boys should find this original method of rail transport of absorbing interest, and many Meccano boys, after reading the article in the January issue, decided to turn their enthusiasm for the locomotive into practical form, with the consequence that literally dozens of reproductions of the engine were entered in both the Home and Overseas Sections of the £100 Contest.



J. Stead's splendid attempt at reproducing the Diesel Locomotive

The general standard of constructional work in these models was very high indeed, but several of the examples were so excellent that the judges decided to send them to the makers of the actual locomotive, so that an unbiased and expert opinion regarding the models might be obtained and the encouraging report that has been received fully justifies their taking this step.

Messrs. Kerr Stuart not only expressed great appreciation of the close resemblance of the models to their actual engine, but were so struck by the general workmanship that they decided to employ several of the photos in a forthcoming press advertisement. A copy of this has just been forwarded to me, and on account of the reference to the models made therein, I cannot refrain from quoting the following paragraphs. They appear under the heading "Meccano-ized and Immortalized."

> "It has often been said that true fame is achieved by a man only after he has been cartooned in *Punch*. In the world of Engineering, it is to-day equally true that a mechanical device achieves real popularity when the embryonic technicians of tomorrow make it in Meccano.
>
> "Picked out from a number of entries in a recent competition, the 'Meccano-ized' versions of the K.S. Diesel Locomotive shown here are therefore, significant. That a number of budding engineers should elect the K.S. as the prototype for their constructive genius speaks volumes for the hold that this ultra-modern locomotive has gained upon the public."

I think readers will agree that this endorses our slogan that Meccano is—"The toy that made engineering famous!"

Before proceeding with descriptions of several of the models submitted I would advise readers to refer back if possible to the January issue of the "*M.M.*" if they are not fully conversant with the appearance of the actual locomotive. For the benefit of those who are unable to refer to this issue, however, I am including a short description of the locomotive herewith, which should enable the reader to appreciate more readily the salient features of the Meccano models.

The locomotive, which has been developed by Messrs. Kerr Stuart & Co., is powered by a four-cylinder Diesel type engine mounted centrally in the frame. The motor is fitted with an orthodox four-throw crankshaft and flywheel, the latter also incorporating one member of a cone clutch, similar to the type that is to be found in many motor cars.

From the clutch the drive is carried by means of a transmission shaft to a gear box situated in the front portion of the frame, the gear box incorporating a reverse drive. The driving wheels, of which there are six, are coupled together by chain and sprocket gearing, and the forward pair is in turn coupled to the gear box by further chain and sprockets. For starting purposes a single cylinder petrol engine is employed, and when set in motion turns over the crankshaft until a working temperature is reached in the cylinders of the main engine. The radiator cooling system and fan are mounted at the rear end of the cylinder block, the radiator itself projecting into the front portion of the cab.

The exhaust system consists of four separate ducts which terminate in a manifold of large diameter, this tube opening into a cylindrical expansion chamber secured to the top of the superstructure of the locomotive. The cab of the engine contains a change speed lever together with two brake controls and also a special mechanism for controlling the governor which regulates the opening of the injector valves, this control corresponding to the "throttle" of a petrol engine.

The first model to be illustrated is that constructed by J. Stead. Stead's model is particularly outstanding for its remarkably neat appearance and external fittings, while the internal mechanism is none the less ingenious. The model is driven by means of a 4-volt Electric Motor that can be seen projecting into the front portion of the cab, its armature shaft being coupled to the rear pair of driving wheels through a two-speed and reverse gear box and Sprocket Chain and Gears. Further Sprocket gearing is then used to couple these wheels with the forward pair of drivers.

This form of construction provides a clear space in the main body of the engine, into which Stead has fitted a 4-volt 8 ampere accumulator, the accumulator being easily removed for charging purposes by opening the hinged "doors." On connecting the accumulator to the terminals of the Motor, the model becomes an entirely self-contained power unit.

Several of the external fittings have also been cleverly designed. The exhaust expansion chamber that is mounted on to the top

of the main body of the engine is composed of a number of Sleeve Pieces, and Chimney Adaptors, these being held together by means of an Axle Rod passing through the centre holes of the Adaptors, and a Collar placed on each end. A Threaded Pin, secured in the threaded hole of one of these Collars represents the short pipe through which the exhaust gases, in the actual engine, finally reach the atmosphere after passing through the manifold and expansion chamber.

The " warning bell " is formed from a Contrate Wheel secured to a Collar, pivotally mounted between two $1\frac{1}{2}''$ Strips on the top of the frame; the " head lamp " and tool box (composed of $1\frac{1}{2}''$ Flat Girders) are also clearly discernable in the illustration.

The model built by W. A. Lavers and illustrated in the centre of this page, reflects quite a different style of construction to the example just mentioned. As will be seen, this locomotive has been built to quite a small scale, and employs a Meccano Clockwork Motor as a means of propulsion. The superstructure and frame of the model is composed almost entirely of Strips and Angle Girders, but an improved effect would have resulted if Flat Plates had been employed in certain portions.

The method of transmitting the drive from the motor spindle to the road wheels is distinctly original, but I very much doubt whether a high standard of efficiency could be attained with this arrangement!

The drive from the motor shaft is first taken by means of Sprocket Chain to a 2" diam. Sprocket secured on a Rod journalled in the Motor side plates. It is then transmitted to a second Rod journalled at right angles to the first, by a 1" Gear and a $\frac{3}{4}''$ Contrate Wheel. The last mentioned Rod carries a Bush Wheel, which is coupled to a further Bush Wheel mounted on an axle carrying the rear pair of driving wheels, by means of a $2\frac{1}{2}''$ Curved Strip held to the Bush Wheels by lock-nutted bolts.

The constructional features of the model show that Lavers was somewhat hampered by the quantity and variety of parts at his disposal, and he had therefore to improvise a number of uses for his available accessories. Bearing this fact in mind, readers will agree that the model is all the more creditable and represents an excellent attempt to "persevere under difficulties."

The realistic and workmanlike appearance of the example built by J. D. Sephton and illustrated on this page will at once be apparent. The model incorporates an entirely novel form of motive power, particulars of which will no doubt be interesting to model-builders.

Neither clockwork nor electricity is employed to rotate the driving wheel of the model, the necessary power being obtained solely from a " rubber tortion " motor, somewhat similar in design to the type of motor generally to be found employed for actuating the propellers of model aeroplanes.

The actual " motor " has been built up from a number of strands of heavy elastic stretched between two rotatable " shackles," placed at either end of the base frame of the locomotive. The front " shackle " is coupled to a two-speed gear box by means of Meccano Spur Gears, and the drive is finally taken to the road wheels by means of Sprocket Chain and Gears. The motor is wound by rotating the small crank handle (composed of Meccano Crank and Threaded Pin) that can be seen to the rear of the model, this handle being attached to the rear " shackle " of the motor unit. The motor is prevented from unwinding when being placed in tension by means of a Pawl and Ratchet device.

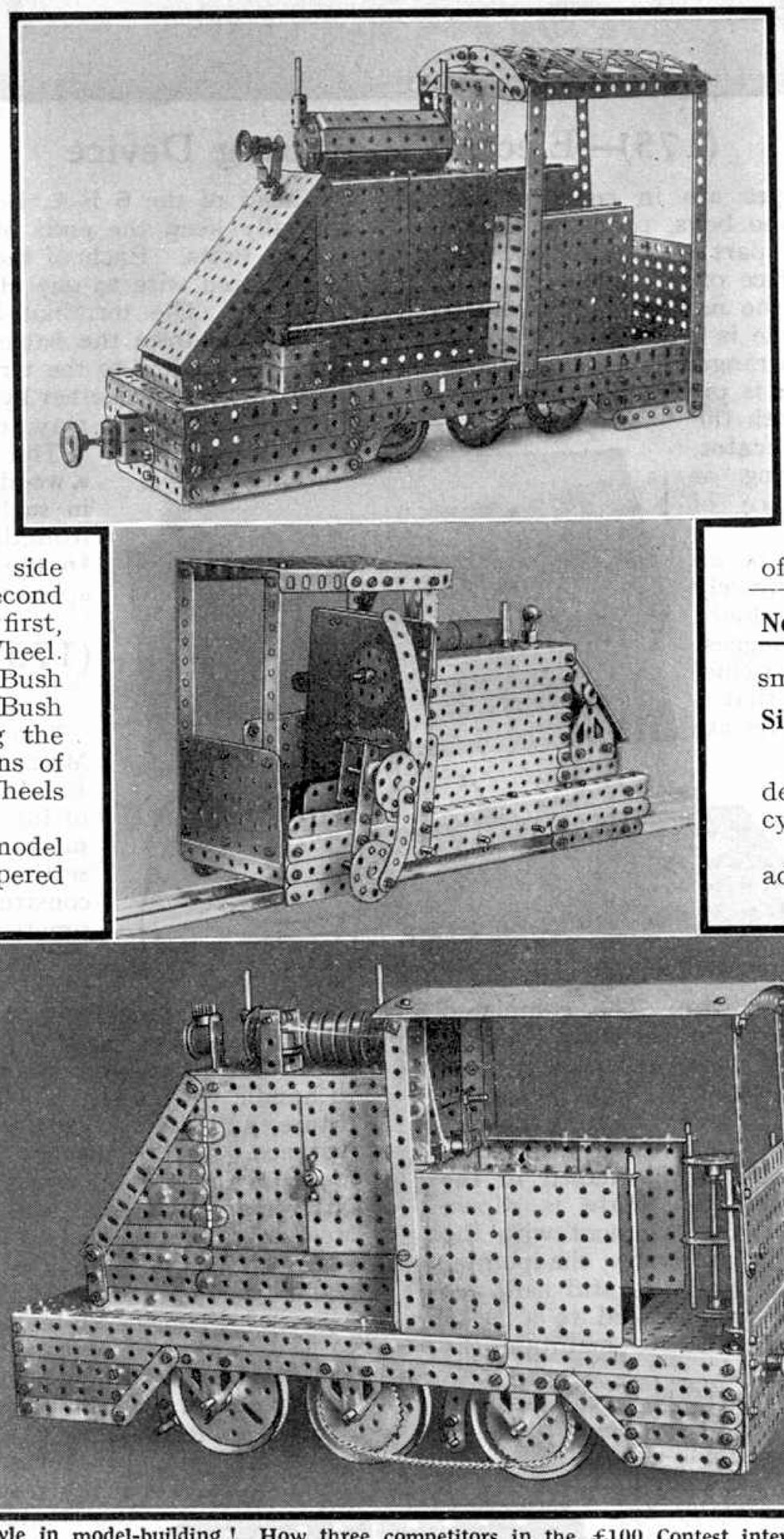
Two brake controls are fitted in the cab of the model. These comprise a lever mounted in a vertical position on the front of the cab and by rotating this a screw brake fitted to the primary shaft of the gear box is brought into action. A hand wheel at the rear of the cab regulates the " rim brakes " on the driving wheels, a screw mechanism again being employed to produce the required movement.

Taken as a whole, the model possesses some really excellent constructional points. The use of cardboard for the roof is not, however, good practice, and in view of the neat cab roofs composed entirely of Meccano parts that are fitted to the other models illustrated, the use of cardboard is quite unnecessary.

The pleasing appearance of the topmost of the three models shown on this page, which was built by H. R. Webb, will also be noted. This model is driven by means of a Clockwork Motor fitted in the cab, the drive being taken to the road wheels through Sprocket gearing.

Perhaps the smallest example entered in the contest was that built by Burton Carnson, a prize-winner in Section E (for Overseas readers).

Carnson's model was designed to a scale that made possible the use of $1\frac{1}{8}''$ Flanged Wheels as the drivers, so readers will understand something of the total size of the locomotive! In spite of this, the model possesses a very compact appearance, Flat and Triangular Plates having been employed judiciously in the building of the engine " housing." The cab of the engine has also been neatly built up and fits in well with the remainder of the model.



Style in model-building! How three competitors in the £100 Contest interpreted the Kerr Stuart Locomotive in model form These examples were constructed by H. R. Webb, W. A. Lavers, and J. Sephton, respectively

New Meccano Models—(*Continued from page 859*

small elastic band or short length of rubber.

Single-Acting Steam Engine

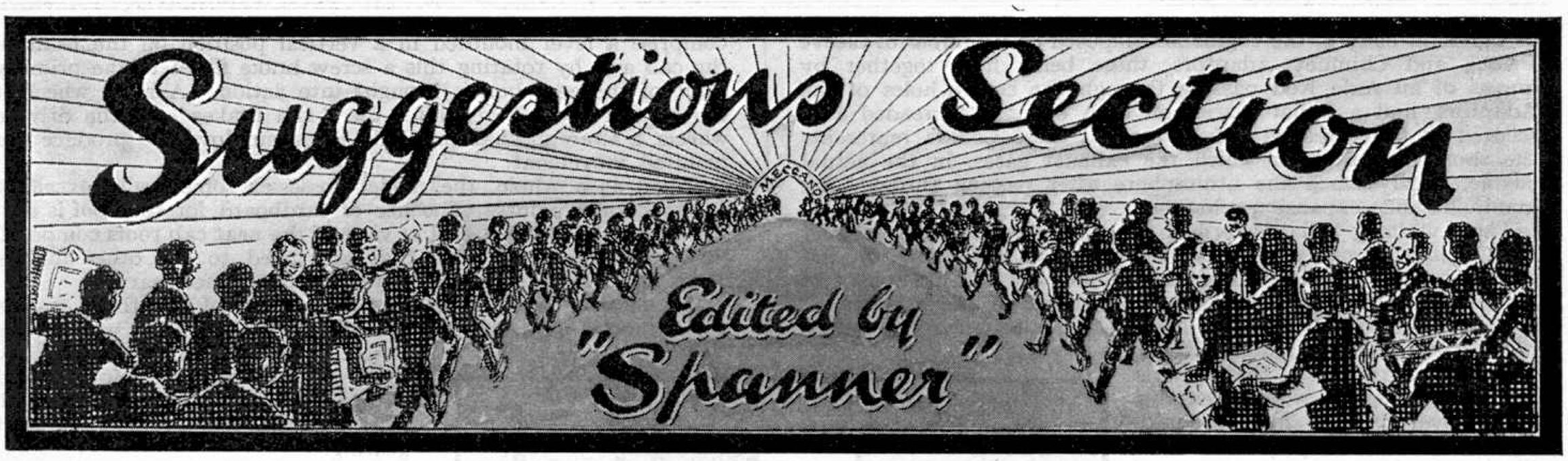
Our final example this month is a model demonstrating the working of a single-cylinder single-acting steam engine.

In a single-acting engine the steam is admitted to the cylinder on the forward stroke, the return stroke being effected by the momentum of the flywheel, the cycle of operations being as follows: As the piston reaches the closed end of the cylinder, the cam on the crankshaft pushes open a mushroom valve in the cylinder head, and steam is admitted. The piston is consequently forced downward, causing the crankshaft to rotate and at the same time automatically closing the inlet valve. The forward stroke is then completed by the expansive force of the steam imprisoned in the cylinder.

To construct the Meccano model a $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate is bolted vertically to a Sector Plate which forms the base. Flat Trunnions are secured to the side flanges of the $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Plate to form journals for the crankshaft, this being built up from two Axle Rods, the crank being formed by two Angle Brackets 3 secured to the bosses of 1" Pulleys. A $2\frac{1}{2}''$ Strip 1 forming the connecting rod is attached pivotally to the Angle Bracket 2 which, in turn, is held in position on a $2\frac{1}{2}''$ Axle Rod by Spring Clips. This Rod represents the " piston," the " cylinder " being formed from a Double Bracket.

The cam on the crankshaft consists of a Flat Bracket 4 secured in position between the faces of two 1" Pulleys.

Parts required to build this model: 1 of No. 3; 1 of No. 5; 1 o No. 10; 1 of No. 11; 3 of No. 12; 2 of No. 16; 1 of No. 17; 1 of No. 18a; 4 of No. 22; 1 of No. 24; 5 of No. 35; 15 of No. 37 5 of No. 37a; 4 of No. 38; 1 of No. 48a; 1 of No. 52; 1 of No. 54 2 of No. 111c; 2 of No. 126a.



(175)—Electric Indicating Device

INDICATING devices of various types are in common use. One of the most familiar to Meccano boys, probably, is the indicator that forms an important part of the electric bell system of every modern house. The face of a typical indicator is provided with holes inscribed with the names or numbers of the various rooms, and behind each hole is a small card, which is free to swing. An electro magnet is arranged in close proximity to each card, so that when a bell push is pressed in any one of the rooms, the current flows through both the bell and one of the magnets of the indicator, causing the appropriate card to swing or oscillate and thus indicating the place of origin of the signal.

The model illustrated in Fig. 175 is an electric indicating device constructed entirely from Meccano parts, and we have little doubt that many uses for this model will suggest themselves to Meccano boys. One of the chief advantages of the device lies in the fact that it only uses current whilst the push switches are operated. Once the indicator has taken up a new position no current is used until it is required to change its position. Fig. 175 is a view of the complete device, and Fig. 175a shows the apparatus dismantled, revealing the solenoids, etc.

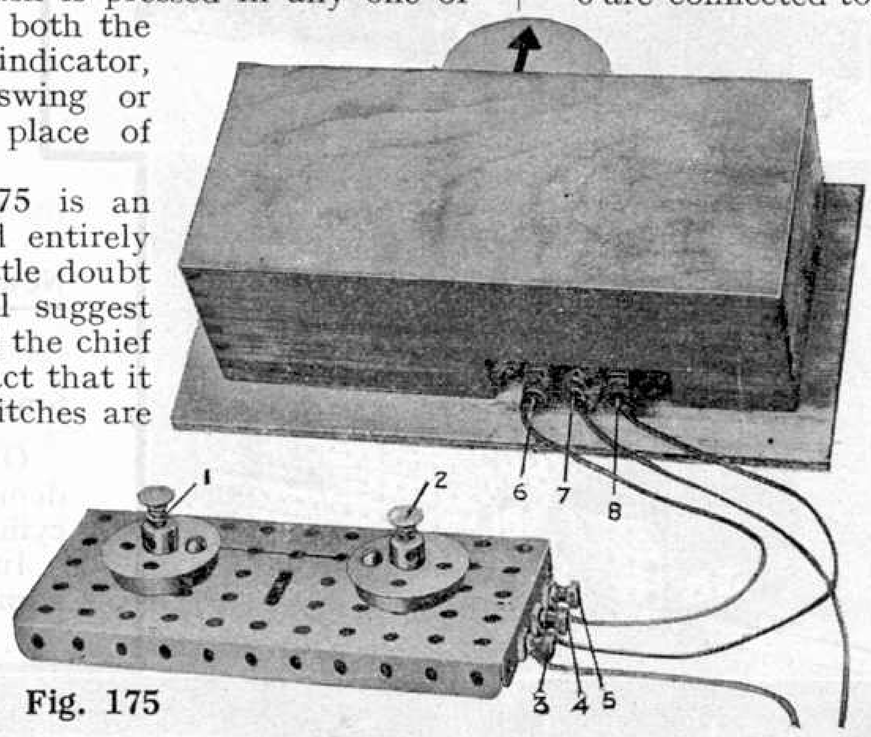


Fig. 175

Each of the operating solenoids consists of a Meccano Bobbin 9, 10 wound to capacity with No. 26 S.C.C. wire. The completed Bobbins are covered with a layer of paper to protect their windings and they are then clamped between $1'' \times \frac{1}{2}''$ Angle Brackets in the position shown. A $4\frac{1}{2}''$ Rod 11 is passed through the centre of both Bobbins, and a Worm is secured midway along its length. Care should be taken to ensure that the Rod works quite freely in the bores of the Bobbins. A short Rod, journalled in the top and bottom Plates of the device (the top Plate is shown removed in Fig. 175a) carries a Pinion in engagement with the Worm on the Rod 11, and on its upper extremity the pointer itself is secured. The latter consists of a piece of stiff card cut to the shape shown in the detail view and secured to a Bush Wheel. A small balance weight 12 is added to maintain the pointer in a state of equilibrium.

One end of the winding of the solenoid 9 is taken to the terminal 6 (Fig. 175) and one end of the solenoid 10 to the terminal 8, whilst the remaining ends of the two solenoids are joined together and connected to the terminal 7. All three terminals must be insulated carefully by Insulating Bushes and Washers from the bare metal of the Plate.

The two push-button switches 1 and 2 are mounted together on a $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate. Each switch consists of a Flanged Wheel with the shank portion of a Spring Buffer working in its boss. The Flanged Wheel is secured by a $\frac{1}{2}''$ Bolt to the Plate, immediately over an insulated 6 B.A. Bolt, so that when the Buffer is depressed, its end makes contact with the head of the 6 B.A. Bolt. Compression Springs, cut in half, normally keep the ends of the Buffers out of contact with the 6 B.A. Bolts. Each of the latter is connected by a short length of insulated wire to one of the terminals 3, 4, both of which are insulated. The terminal 5, however, is uninsulated.

One lead from the battery is taken to the terminal 3 and the other is attached to the terminal 7, whilst the terminals 4, 8, and 5, 6 are connected together by similar wire. The length of these wires may, of course, be varied as necessary.

The entire mechanism may be enclosed in a wooden case as shown in Fig. 175 and secured in such a position that the pointer protrudes from the box when in the " engaged " position. In the disengaged position, the pointer disappears inside the box.

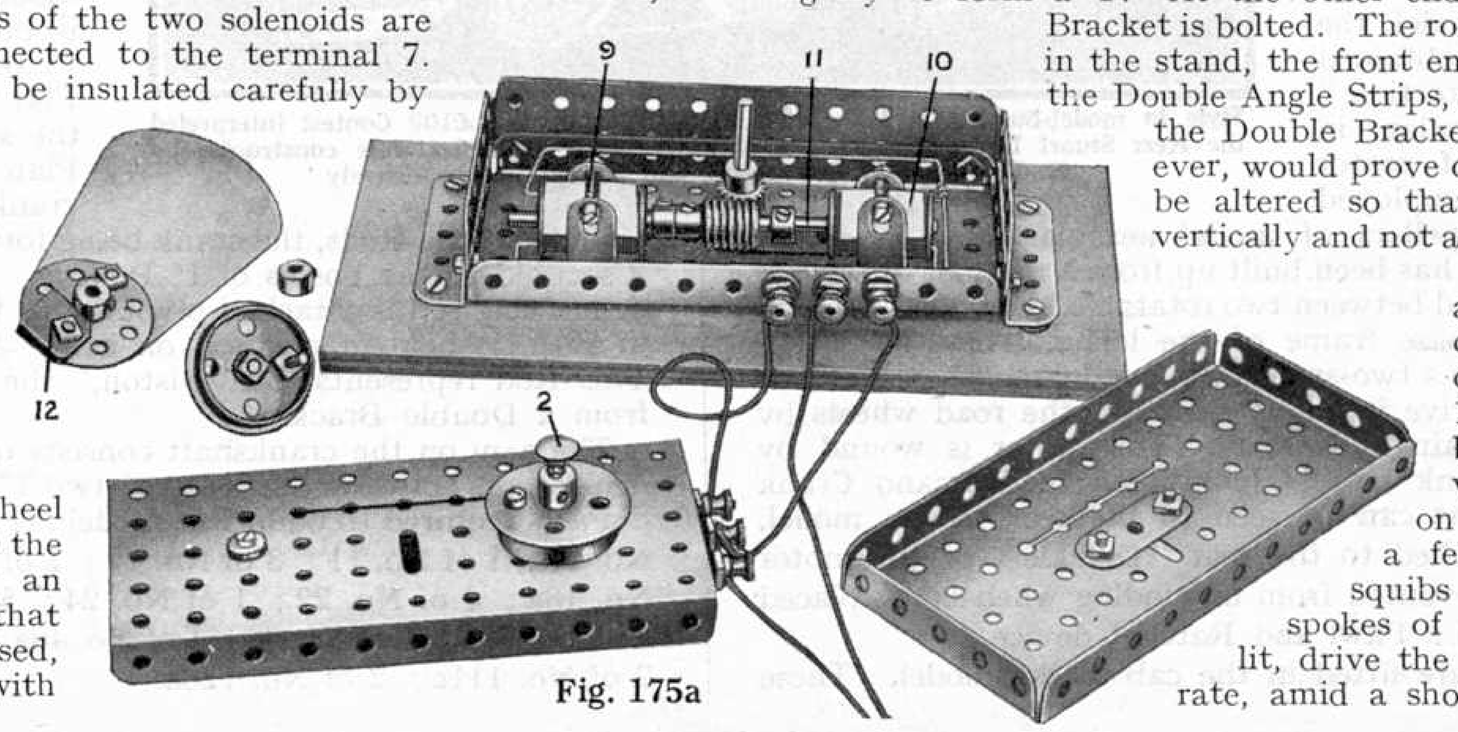


Fig. 175a

(176)—Meccano and Fireworks

(J. McColl, London)

There is little doubt that the uses to which Meccano may be put are extremely varied. Besides the building of small outfit models of the simplest possible description, up to the most complicated ones such as the Block-setting Crane or Dragline, it is possible to construct models that may be put to really practical use. The Meccanograph and Loom are two cases in point. Then again many boys contrive interesting devices for use in the home or workshop. Amongst the novel devices of this type recently suggested are the fire-work holders described by J. McColl.

Our contributor points out that fireworks are unpleasant things to handle when there is a prospect of them going off in the near future, and that in such a case it is advisable to retire to a safe distance. If the display is not to be spoilt however, holders must be devised for many kinds of fireworks in order that the latter may show off to the best advantage. And for this purpose Meccano parts are suited admirably.

A bottle forms a fairly efficient rocket stand, but a Meccano stand is more novel. That built by McColl consists of two $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plates joined together by $5\frac{1}{2}''$ Angle Girders to form a base 14" long. At one end of the base are erected two $3\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips placed together so that their short ends point in opposite directions; the latter are bent upwards slightly to form a Y. At the other end of the base a Double Bracket is bolted. The rocket is placed in position in the stand, the front end of its stick resting on the Double Angle Strips, and the rear end under the Double Bracket. Such a stand, however, would prove dangerous, and it should be altered so that the rocket is placed vertically and not at an angle to the ground.

Another interesting appliance is in the form of a wheel, the spokes of which are formed by $12\frac{1}{2}''$ Strips that are bolted to a Face Plate, which is free to revolve on a long nail driven into a fence or a tree. Large squibs are attached to the spokes of the wheel and, when lit, drive the wheel round at a rapid rate, amid a shower of golden fire.

(177)—Automatic Gear Change

(J. Collins, Rotherham)

Perhaps one of the greatest difficulties that the beginner in motoring has to master is the art of changing gear. To avoid engaging a lower gear, a tyro often will charge a hill at high speed in the hope of getting up "on top," and when the engine starts to "knock" or slow down he resorts to slipping the clutch and subjecting the car to all kinds of abuse, merely to save himself that gear change. An experienced motorist will tell him, however, that he will soon ruin his engine and transmission, and that the only manner in which he can get long service from his car is to treat it with a certain amount of respect! This entails, amongst other things, an intelligent use of the gearbox.

Realising that many potential buyers of cars are chary of purchasing on this ground alone, motor engineers have given much attention to the type of gear box that will facilitate gear changing. A well known British firm has, for example, perfected a gearbox that they claim is practically foolproof. One drawback of motoring for the ordinary individual has thus been eliminated.

The device illustrated in Fig. 177 is a Meccano demonstration model of an automatic change gearbox.

The Rod on which the 1½" Contrate Wheel 1 is mounted, is journalled in the Motor side plates and is driven from the armature spindle through a 3 : 1 reduction ratio. A similar Contrate 2 is secured on a Rod that is journalled in the gearbox in such a manner that its end is in line with the Rod carrying the Contrate 1. A Coupling, with a 1" Rod held in each end, is then placed on the Rod, and a ½" Pinion is mounted loosely on each 1" Rod, being held in place by a Collar 3. The Contrates mesh with the Pinions and the Coupling is free to rotate about its Rod.

The Rod carrying the Contrate 2 has secured to it a ¾" and a ½" Pinion, which engage in turn with their respective Gears 6 and 7 when the Rod on which the latter are secured is slid laterally in its bearings.

A Crank 4 is secured to a short vertical Rod that carries also two Double Arm Cranks. The latter are connected by short lengths of cord to the Collars 3, and the end of Crank 4 is fitted with a bolt, the shank of which engages between two Collars on the sliding shaft.

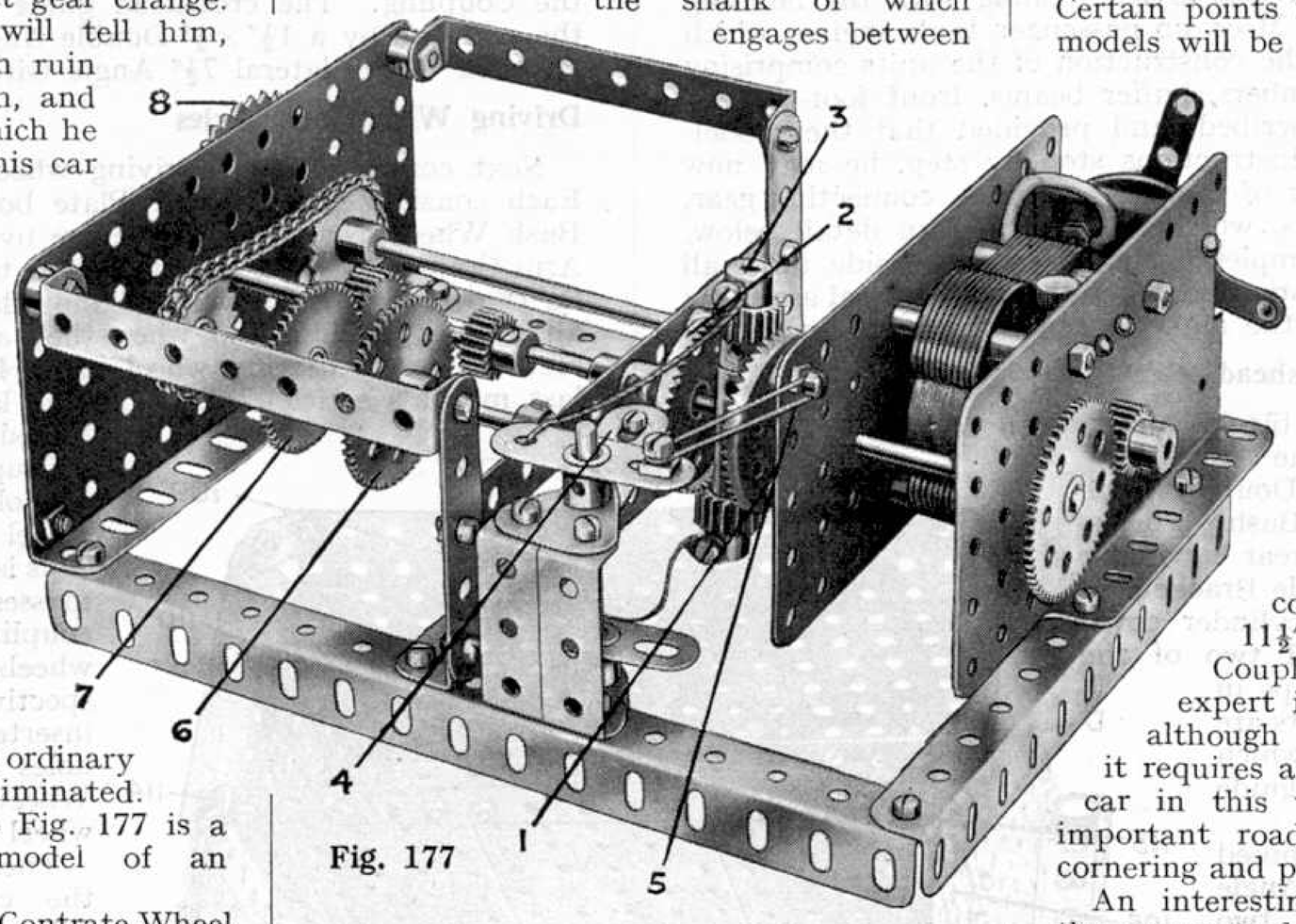


Fig. 177

A short piece of thin elastic 5, attached to the end of the upper Double Arm Crank and to the Motor, normally keeps the ¾" Pinion and 50-teeth Gear 7 in mesh. When, however, an extra load is thrown on the device, the Pinions tend to climb round the teeth of the Contrate 3, thus pulling over the Crank 4 against the action of the elastic 5, and causing the lower gear to come into action. The drive from the gear box is taken off the 2" Sprocket Wheel 8, which is secured to a Rod that is connected to the sliding Rod by a Sprocket drive.

(178)—Automatic Release Gear

(C. Sharpe, Canterbury)

The ingenious gear shown in Fig. 178 may be fitted into any form of Meccano drop-hammer. A good example of this type of model is shown in the Manual of Instructions (Model No. 6.34).

The drive is transmitted to the hoisting drum through a reduction gear of 2 : 1 comprising a ¾" Pinion engaging with a 50-teeth Gear Wheel secured to the drum shaft. The drum consists of two 1⅛" Flanged Wheels butted together.

The Worm 1 is fixed to the driving shaft and meshes with a ½" Pinion that is secured to a Rod journalled in two Trunnions. A Handrail Support 2 is fixed to this Rod, and when rotated, its shank engages periodically with a ½" loose Pulley 3, which is held loosely on the Rod 4 between two Collars.

This has the effect of pushing the Rod 4 to the left, thus throwing the 50-teeth Gear Wheel out of mesh with the ¾" Pinion, and disengaging the drum from the driving shaft. Almost immediately the loose Pulley is released from the Handrail Support and the sliding Rod returns to its original position, so re-engaging the 50-teeth Gear with the ¾" Pinion, when the process is repeated.

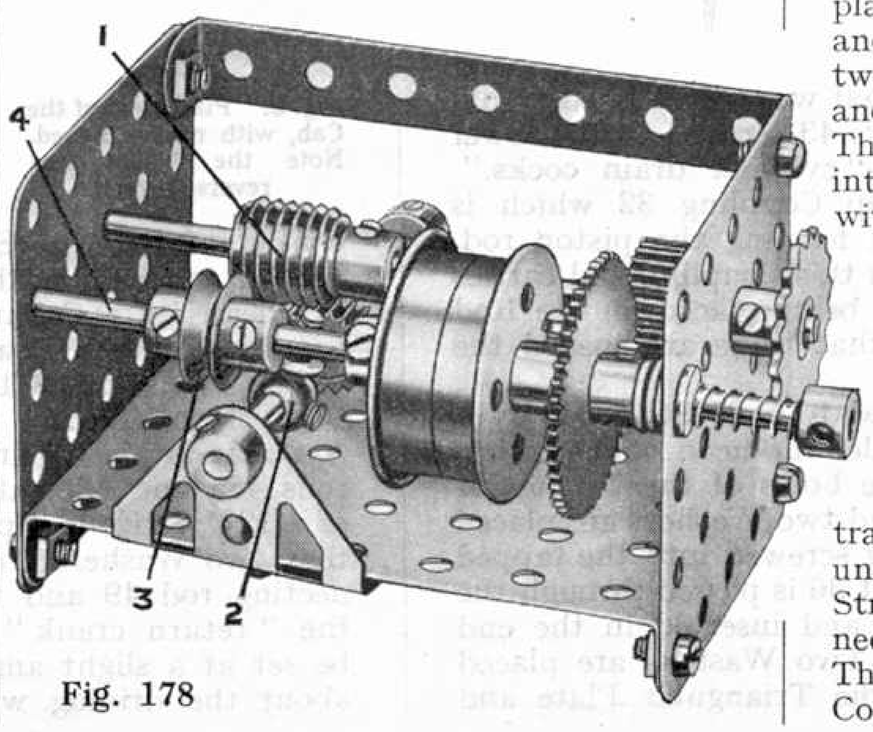


Fig. 178

Miscellaneous Suggestions

Under this heading "Spanner" replies to readers who submit interesting suggestions regarding new Meccano models or movements that he is unable to deal with more fully elsewhere. On occasion he offers comments and technical criticisms that, he trusts, will be accepted in the same spirit of mutual help in which they are advanced.

(M.72). Novel Meccano Motor Cars.—C. G. Leuty, of Birkenhead, has forwarded a description of some interesting Meccano motor cars that he has built and with which he has organised some novel races. Certain points in the construction of the models will be of general interest and we are therefore appending extracts from Mr. Leuty's letter.

"Our aim," he writes, "was to build vehicles outwardly realistic, but not to run under their own power, and to construct 'roads' in the garden on which to 'drive' them. Power was provided by our own hands, and in order to save stooping whilst driving, an extension rod was fitted to the steering column. This consisted merely of a few 11½" Rods joined end to end by Couplings. We became quite expert in driving in this manner, although anyone who tries will find it requires a little skill to manœuvre a car in this way when driving in an important road race requiring constant cornering and passing other competitors!"

An interesting gadget incorporated in the cars was designed solely for the purpose of making a noise. "The idea was to obtain the effect of an open exhaust on our racing cars, and it sounds quite real if suitable tin is used. Included in the engine unit is a horizontal Rod equipped with eight Collars carrying ordinary bolts in place of set-screws and secured in different positions on the Rod, while on the inside of the engine casing a piece of tin is bolted so that when the Rod revolves the bolt heads strike the edge of the tin at different intervals. Fitted to the piece of tin is a length of wire by means of which the tin may be pulled out of range of the bolt heads when desired.

"The horizontal Rod is made slidable so that when the gear lever is moved, either two or four bolts are moved out of touch with the tin sheet. Thus, when the car is in bottom gear, all the bolts on the eight Collars are striking the tin plate. To change into 'second' the plate is pulled out of range of the bolts and the gear lever moved, so bringing two bolts out of touch with the tin sheet, and thus a silent change of gear is made(!). The same procedure is followed to change into top, when there are only four Collars within range of the tin."

We think many Meccano boys would consider that the advantages obtained scarcely justify the intricate nature of this "mechanical exhaust." Nevertheless the effects obtained must be most realistic.

(M.73). An Improvised Universal Coupling.—L. Jones (Hampton, Australia) submits an ingenious built-up universal coupling. It consists of two Strip Couplings or End Bearings connected together by means of a Hinge. The latter is retained in the slots in the Couplings by means of Bolts.

Baltic Tank Locomotive

Completion of Instructions for Building this fine Model

IN the first instalment of this article dealing with the building of the "Baltic" type Meccano passenger tank engine, which appeared last month, the construction of the units comprising the main frame, side members, buffer beams, front foot-plating, and driving gear was described, and provided that the model-builder has followed our instructions step by step, he may now proceed with the assembly of the valve motion, connecting gear, boiler, cab, and side tanks, which are described in detail below.

Each unit on being completed should be laid aside until all the sections have been constructed, when the work of final assembly may be carried out with the aid of a few extra nuts and bolts.

The Cylinder Blocks, Crosshead, etc.

The left-hand cylinder block can be seen in position on the main frame in Fig. 7. The "cylinder" consists of five $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips secured to two Bush Wheels, which form the front and rear "cylinder covers." Two $\frac{1}{2}'' \times \frac{1}{2}''$ Angle Brackets 29 are secured to the rear cylinder cover by bolts which also hold two of the $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips in place, and to these Brackets are secured $4\frac{1}{2}''$ Strips 30 which represent the "crosshead guide bars."

The valve chest is composed of three $3\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips secured between two Bush Wheels. The valve spindle 38 is a $4\frac{1}{2}''$ Rod upon which is secured two 1" fast Pulleys spaced apart by means of a Coupling, these last mentioned parts representing the piston type "slide-valve."

The cylinder and valve chest are mounted upon a $2\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plate which, in turn, is held to the main frame by means of four $\frac{3}{4}''$ Bolts, a Collar and two Washers being slipped on to each Bolt before attaching to the frame, in order to secure correct alignment of the piston and valve rod with respect to the connecting gear.

The "lagging" plate 41, which consists of two $2\frac{1}{2}''$ Flat Girders held together by 2" Strips, is secured to both the cylinder and valve chest. The $2\frac{1}{2}''$ Double Angle Strip 27a is held in place at the rear end by means of a Flat Bracket; a bolt could not be used here in the usual way as its head would foul the "combining lever" 54. Collars 43 secured to the lower portion of the cylinder represent the "cylinder drain cocks."

The "crosshead" consists of a Strip Coupling 32 which is secured to the end of a $6\frac{1}{2}''$ Axle Rod forming the piston rod. A 1" length of Screwed Rod is secured in this Coupling and carries at either end an Eye Piece 33, Washers being placed on the Rod before fitting the Eye Pieces in order that these are spaced the correct distance apart.

A 1" Triangular Plate is now attached to a 2" Strip 34, by a nut and bolt, a Washer being placed under the head of the latter. A Bolt 35 is passed through one of the holes of the Triangular Plate and the top hole of the Strip 34, and two Washers are placed on the shank of the bolt, this then being screwed into the tapped hole of the upper Eye Piece 33. A $\frac{3}{8}''$ Bolt 36 is passed through the remaining hole of the Triangular Plate and inserted in the end tapped bore of the Strip Coupling 32. Two Washers are placed on the shank of the $\frac{3}{8}''$ Bolt between the Triangular Plate and the Coupling. The crosshead guide bars 30 are held rigidly at the rear end by a $1\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip 42, this also being fastened to the lateral $7\frac{1}{2}''$ Angle Girder 28.

Driving Wheels and Axles

Next construct the "driving wheels" 44a, 44b, 44c (Fig. 1). Each consists of a Circular Plate bolted to a Hub Disc, and a Bush Wheel secured to the centre by nuts and bolts. A Double Arm Crank 45a, 45b, 45c, is bolted to each driving wheel so that its centre is 1" from that of the wheel. Six driving wheels in all will be required and when they are completed, they may be secured to the driving wheel axles 46a, 46b, 46c (see Fig. 1 in last month's article). Each of the latter consists of a $4\frac{1}{2}''$ Rod joined to a 1" Rod by means of a Coupling. A 25 gramme Weight is bolted to the centre driving wheel 45b in the position shown. This is to balance the reciprocating masses of the connecting and coupling rods, etc. The driving wheels are secured to their respective axles by two set-screws inserted in each of the set-screw holes of the new style Bush Wheels that are bolted to the wheel centres.

The $3\frac{1}{2}''$ Gear 25 is secured to the centre driving wheel axle 46b as shown in Fig. 1. This Gear—as was mentioned last month—meshes with the $\frac{3}{4}''$ Pinion secured to the $2\frac{1}{2}''$ Rod that carries the 57-teeth Gear 24.

Each pair of driving wheels on any one axle must have their crank pins *exactly at 90 degrees to one another*. This is very important, for if the pins are not exactly at right angles the coupling rods will bind and so prevent the model working satisfactorily. The cranks in a two cylinder steam locomotive are set in the same way.

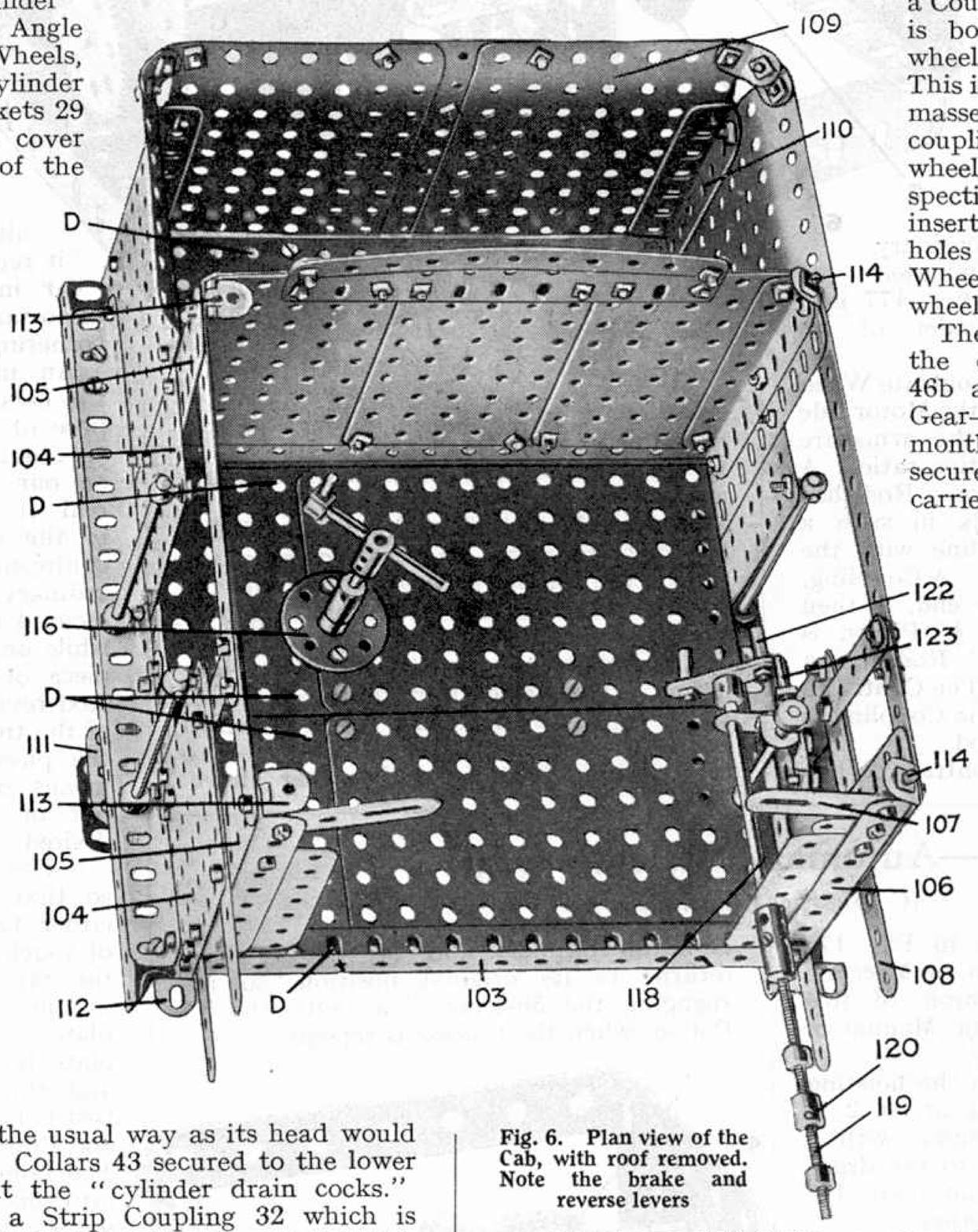


Fig. 6. Plan view of the Cab, with roof removed. Note the brake and reverse levers

The Motion (Valve-Gear, Connecting Rods, etc.)

The leading and trailing driving wheel crank pins consist of Pivot Bolts (47a in Fig. 7) which are held in the bosses of the Double Arm Cranks (45a, Fig. 7) by set-screws. One end of each of the "coupling rods" 48a, 48b, which consist of two $7\frac{1}{2}''$ Strips, is journalled on each Crank Pin and spaced away from the boss of each of the Double Arm Cranks by means of a Collar on each crank pin. This is to enable the coupling rods to clear the flanges of the driving wheels.

The crank pin 47b consists of a $1\frac{1}{2}''$ Rod held rigidly in the bore of the Double Arm Crank 45b by the latter's set-screws. A Collar is placed first on the crank pin, and then the coupling rods 48a and 48b, after which the connecting rod 49, consisting of a $12\frac{1}{2}''$ Strip, is slipped into place. Care should be taken to see that two Washers are placed on the crank pin between the connecting rod 49 and the ends of the two coupling rods. Lastly the "return crank" 50 is secured in place. This Crank must be set at a slight angle so that its end describes a circular path about the driving wheel centre.

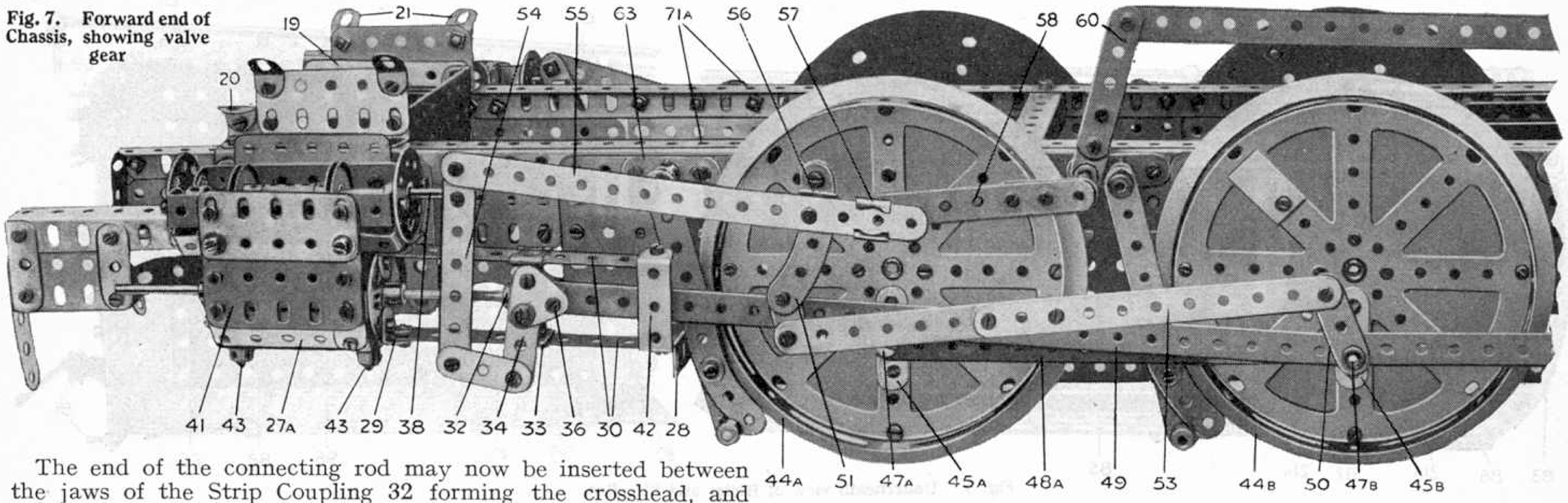


Fig. 7. Forward end of Chassis, showing valve gear

The end of the connecting rod may now be inserted between the jaws of the Strip Coupling 32 forming the crosshead, and the $\frac{3}{8}$" Bolt 36 by which the connecting rod is attached to the crosshead, screwed home.

The "expansion link" 51 consists of two $2\frac{1}{2}$" large radius Curved Strips connected together by $\frac{3}{8}$" Bolts and spaced apart by four Washers on each of the bolts, a Flat Bracket being secured rigidly to the expansion link by the lower $\frac{3}{8}$" Bolt. The expansion link will eventually be attached pivotally by means of a lock-nutted bolt (Standard Mechanism No. 262) to the Architrave 52 that is bolted to the footplating (see Fig. 5). An Eye Piece 56 slides freely on the front $2\frac{1}{2}$" Curved Strip of the expansion link 51. In the actual engine this movement modifies the travel of the piston valve and thus regulates the backward and forward motion of the locomotive.

The motion of the return crank 50 is transmitted to the expansion link by means of the Strips 53, which are attached pivotally to both the return crank and the Flat Bracket on the expansion link by lock-nutted bolts.

The "combining lever" 54 comprises a $3\frac{1}{2}$" Strip pivoted in the second hole from its top end on a set-screw which is inserted in the tapped hole of a Collar. This Collar is secured on the end of the valve spindle 38. The end of the combining lever is connected to the 2" Strip 34 by a short pivoted link, consisting of a $1\frac{1}{2}$" Strip attached to the Strips 34 and 54 by lock-nutted bolts. The "radius rod" 55—a $7\frac{1}{2}$" Strip—is attached pivotally to the top end hole of the combining lever by a lock-nutted bolt. The other end of the radius rod is attached to the Eye Piece 56 by a $\frac{3}{8}$" Bolt held in the bore of the Eye Piece by the latter's set-screw. The radius rod must be bent slightly, for the points of attachment to the combining lever and the Eye Piece 56 are not in a straight line.

The end of the radius rod projecting beyond the Eye Piece 56, or "die block," slides in an Eye Piece 57 that is attached pivotally to the $3\frac{1}{2}$" Strip 58. This latter Strip is bolted rigidly to a Crank secured on the end of the weigh shaft (a $6\frac{1}{2}$" Rod), journalled in the holes 59 of the main frames (Figs. 1 and 3). A second Crank to which a $2\frac{1}{2}$" Strip 60 is bolted, is also secured to the weigh shaft in the position indicated, close to the main frame. The Strip 60 will be connected to the Threaded Boss 120 (Fig. 6) by means of a $12\frac{1}{2}$" Strip when the model is assembled.

The right-hand motion is exactly similar in every respect to that shown in the illustrations except that the Crank to which the $12\frac{1}{2}$" Strip is secured is not duplicated on the other end of the weigh shaft. The cranks 58 secured on each end of the $6\frac{1}{2}$" Axle Rod forming the weigh shaft are parallel.

The Brake Rigging

Each of the "brake blocks" consists of a $2\frac{1}{2}$" large radius Curved Strip bolted to a $4\frac{1}{2}$" Strip 62 (Fig. 7); a Washer is placed beneath the head of the bolt securing the brake block to the $4\frac{1}{2}$" Strip. Each of the $4\frac{1}{2}$" Strips is hung from a pivot composed of a 1" Rod secured in a Double Arm Crank 63 that is attached to the main frames in the position indicated in Fig. 3. The Strips are retained on the 1" Rods by means of Collars. Each pair of "brake hangers" (as the $4\frac{1}{2}$" Strips are usually termed) are connected together by a $6\frac{1}{2}$" Rod 64 (Fig. 1) which is inserted in the bottom hole of the brake hangers, being retained thereon by Collars. A Strip 65 14" long (obtained by bolting a $12\frac{1}{2}$" and a 3" Strip together) connects all the brakes.

The Crank 66 is secured on a 5" Rod journalled in holes in the main frames, and is connected to the $6\frac{1}{2}$" Rod 54 by a $9\frac{1}{2}$" Strip 67. The latter is attached pivotally to the Crank 66 by means of a lock-nutted bolt. On the same Rod carrying the Crank 66 is secured a second Crank 68 which has its arm prolonged by a 2" Strip. The end of the latter carries a $1\frac{1}{2}$" Strip 69 that is pivotally attached to the end of the Crank 68. The "brake pull rods" 65 and 67 are retained on the $6\frac{1}{2}$" Rods 64 by means of Collars half way between the right and left-hand set of brakes, so that the pull of the rods may be distributed equally and all the brake shoes operated simultaneously.

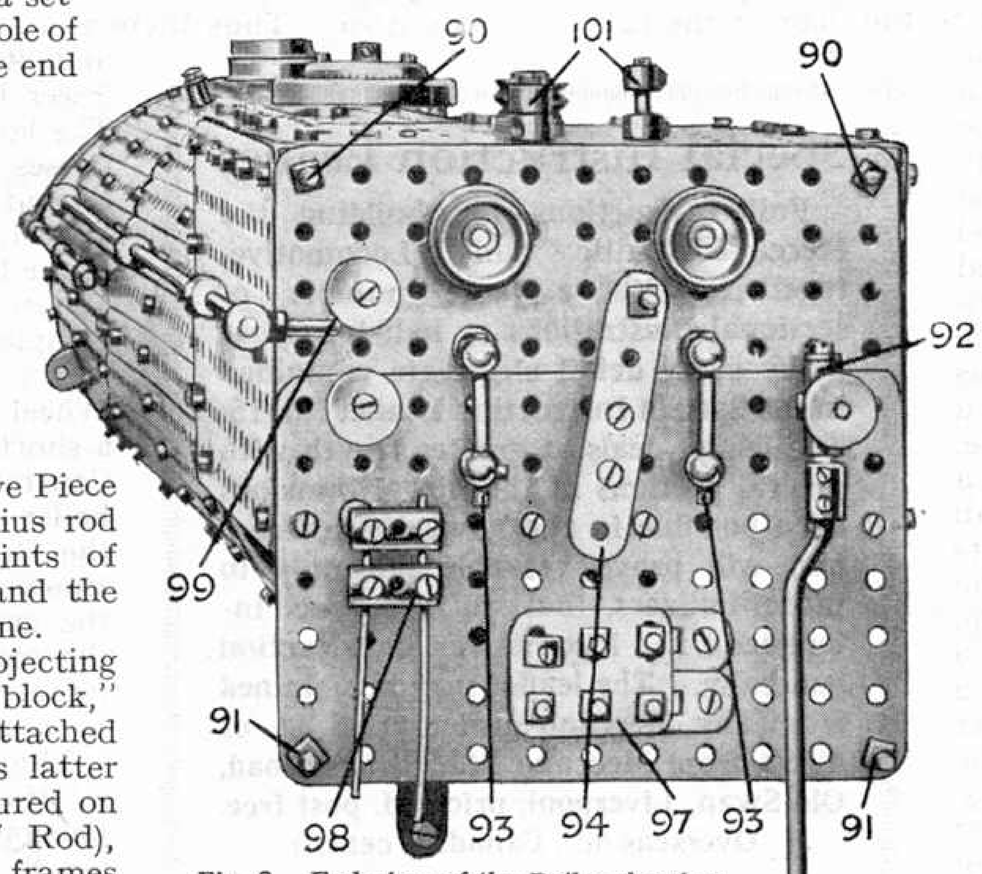


Fig. 8. End view of the Boiler showing boiler fittings and Motor control lever (94)

Construction of the Cab, Bunker, etc.

The floor of the cab (Figs. 6 and 10) is composed of six $3\frac{1}{2}$" × $5\frac{1}{2}$" Flat Plates, each pair of Plates overlapping seven holes in the direction of the width of the cab. In the direction of the cab's length the Plates are placed edge to edge or "butted together," as it is termed. Each side of the floor is bolted to a $9\frac{1}{2}$" Angle Girder 102 (Fig. 10) extended 1" by a 2" Angle Girder that is secured to it. A $7\frac{1}{2}$" Angle Girder 103 is bolted across the front edge of the floor as indicated in both illustrations. The $4\frac{1}{2}$" × $2\frac{1}{2}$" Flat Plates 104, which form the sides of the cab, are bolted rigidly to the Angle Girders 102.

The bunker sides, which consist of $5\frac{1}{2}$" × $3\frac{1}{2}$" Flat Plates bent over at the top, are bolted to the edges of the two rearmost cab side Plates 104, and to the Angle Girders 102. Four $5\frac{1}{2}$" Flat Girders 105 are secured to the Plates 104 in the positions indicated, whilst $4\frac{1}{2}$" Angle Girders 106 are secured to the front edges of the foremost Flat Girders 105, a 2" Slotted Strip 107 being secured to the top of each of the former. Four $3\frac{1}{2}$" Strips 108 are attached to the cab side Plates 104 in the positions shown. Two $4\frac{1}{2}$" Angle Girders bolted to the rearmost Flat Girders 105 form a convenient means of attaching the back of the cab to the sides. The back of the cab consists of three $4\frac{1}{2}$" × $2\frac{1}{2}$" Flat Plates, their bottom edges being bolted to a $7\frac{1}{2}$" Flat Girder. A $5\frac{1}{2}$" Flat Girder is secured midway along the top edge of the back of the cab, and a $5\frac{1}{2}$" Curved Strip is, in turn, bolted to it.

The back of the bunker consists of two $3\frac{1}{2}$" × $5\frac{1}{2}$" Flat Plates 109 which are connected together by a $5\frac{1}{2}$" × $2\frac{1}{2}$" Flat Plate that overlaps each of the Plates by two holes. The back is now secured in position by being bolted to the $5\frac{1}{2}$" Angle Girders 110. The extreme lower ends of the latter carry the rear buffer beam, which consists of a $7\frac{1}{2}$" Flat Girder. The steps 111 each consist of two $1\frac{1}{2}$" Angle Girders bolted to a pair of $3\frac{1}{2}$" Strips that are attached to the Angle Girder 102.

It should be noted that the front cab side plates 104 have $4\frac{1}{2}$" Flat Girders attached to their rear edges, the Handrail Supports carrying the handrails being attached to these Flat Girders. The bottom ends of the handrails rest on $9\frac{1}{2}$" Angle Girders, to the

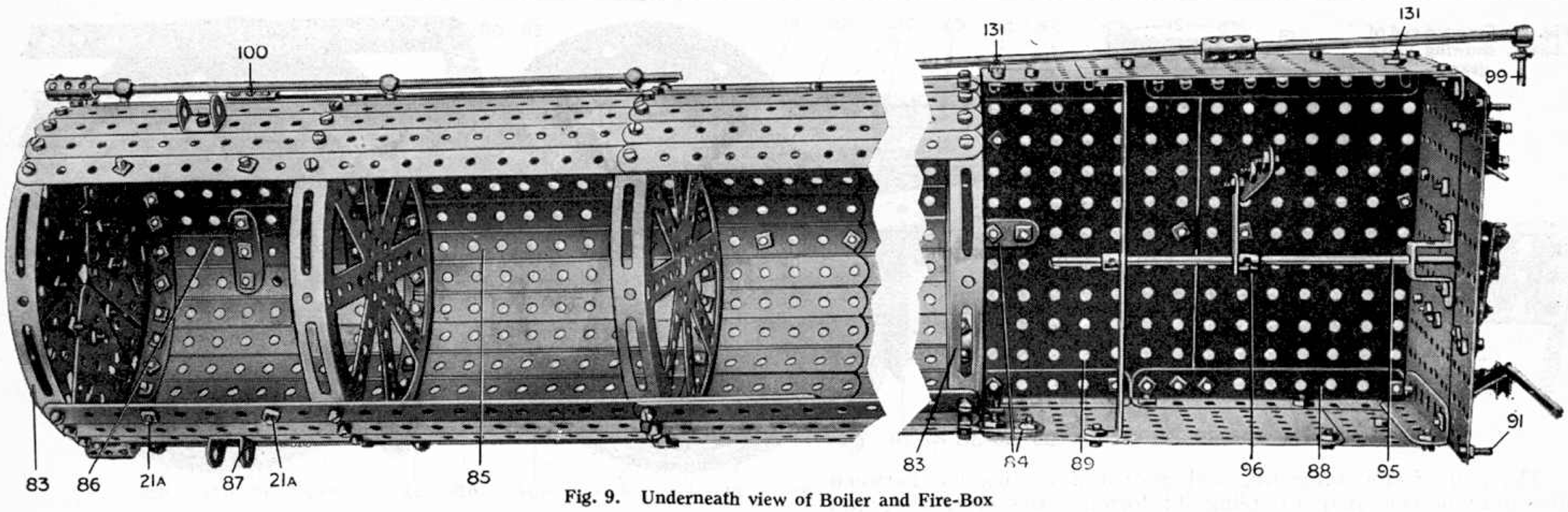


Fig. 9. Underneath view of Boiler and Fire-Box

front end of which 1″ Reversed Angle Brackets 112 are attached. This Girder forms part of the running board and is secured to a similar Girder bolted to the second line of holes from the bottom of the cab side Plates 104. The top ends of the Flat Girders 105 on each side are connected together by a $5\frac{1}{2}$″ and a $2\frac{1}{2}$″ Strip, overlapped two holes.

The cab roof (see general view, Fig. 2, in last month's article) consists of four $5\frac{1}{2}'' \times 3\frac{1}{2}''$ Flat Plates, each pair being overlapped four holes in the direction of the width of the cab. The two pairs of Plates are placed edge to edge and connected together by $5\frac{1}{2}$″ Strips bolted across both sets of Plates. The cab roof is attached to the hinges 113 (Fig. 6) which permits of easy access to the cab's interior. When the roof is closed, the shanks of the bolts 114 project through holes in the cab roof, and nuts are placed on the ends of the bolts to keep the cab roof in place.

Brake Control and Reversing Gear

The hand brake consists of a 2″ Screwed Rod 115 journalled in a Bush Wheel 116 (Fig. 6) that is fixed to the floor of the cab. A Threaded Coupling is attached to the upper end of the Screwed Rod, whilst a Threaded Boss 117 is free to move on the lower extremity of the Rod, its travel only being limited by Collars secured on the Rod in the positions shown in Fig. 10. A 2″ Rod is held in the plain bore of the Threaded Coupling (Fig. 6) and a second 2″ Rod connected at right angles to the top of the former Rod by means of a Coupling, forms the handle. A Threaded Pin is secured to a Collar and fastened to one end of the handle.

A $3\frac{1}{2}$″ Rod 118 (Fig. 6) is journalled in a $1'' \times 1''$ Angle Bracket secured to the cab side plate 104 by two $\frac{3}{8}$″ Bolts, three Washers on each of the $\frac{3}{8}$″ Bolts serving to space the $1'' \times 1''$ Angle Bracket from the cab side. The other end of the $3\frac{1}{2}$″ Rod carries a Threaded Coupling and is journalled in a $3\frac{1}{2}$″ Flat Girder bolted to the Angle Girder 106. A $3\frac{1}{2}$″ Screwed Rod 119, secured in the tapped bore of the Threaded Coupling, carries a Threaded Boss 120, the travel of which is limited by two stops consisting of Collars which are secured to the Rod. The Rods 118 and 119 are rotated by means of the Double Arm Crank 122 that is fastened on the end of the former Rod. End play of the Rod 118 is prevented by a Collar 121 that is secured on the Rod 118 behind the Flat Girder in which the Rod is journalled.

The driver's brake valve 123 simply consists of a Threaded Pin that is inserted in the set-screw hole of a Collar secured to a 3″ Rod. The upper end of this Rod is retained in position by a $\frac{1}{2}'' \times \frac{1}{2}''$ Angle Bracket bolted to the $1'' \times 1''$ Angle Bracket in which the Rod 118 is journalled, the other end of the Rod passing through a hole in the cab floor. This completes the construction of the cab unit.

Details of the Side Tanks

The construction of the side tanks is shown clearly in the general view. The top edges of the four $3\frac{1}{2}'' \times 5\frac{1}{2}''$ Flat Plates forming the tank sides are bolted to an $18\frac{1}{2}$″ Angle Girder to which the tank top (a $12\frac{1}{2}$″ and a $7\frac{1}{2}$″ Flat Girder) is secured. The running board consists of a $9\frac{1}{2}$″ and a $7\frac{1}{2}$″ Angle Girder overlapped three holes and is bolted to the bottom edge of the tank sides. The front edges of the Flat Girders forming the tank tops should project beyond the tank sides to form a beading. To this end the Flat Girders are secured by their slotted holes to the Angle Girders 124. The $\frac{1}{2}'' \times \frac{1}{2}''$ Angle Brackets 126 and 127 are for the purpose of securing the side tank to the side of the fire-box and front footplating respectively, as will be seen on reference to the general view that appeared in last month's article (Fig. 2).

The Boiler and Fire-Box

The details of the construction of the boiler and fire-box are shown clearly in Fig. 9 and also in the general view (Fig. 2). The "boiler shell" is composed of a number of lengths of $12\frac{1}{2}$″ Strips, each length consisting of two $12\frac{1}{2}$″ Strips overlapped six holes, and bolted to Hub Discs 83. The three $12\frac{1}{2}$″ Strips 84, however, are overlapped four holes, so that the rearward projection portions may be bolted to the fire-box.

The Strip 85 is $9\frac{1}{2}$″ in length, a continuation of it being formed by a $2\frac{1}{2}$″ Strip 86 bolted to the Hub Disc representing the smoke-box door. Thus there is a gap between the ends of the Strips 85 and 86 in which is placed the boss of the lower Flanged Wheel forming the chimney The latter is secured in place by a bolt that passes through the end hole of the $2\frac{1}{2}$″ Strip 86 and one of the holes of the lower Flanged Wheel. A short Rod is secured in the boss of the Flanged Wheel, and a second Flanged Wheel secured thereon boss downward, completes the chimney.

The steam dome consists of a $1\frac{1}{2}$″ Contrate Wheel placed on the top of a Wheel Flange, a short Rod which is held in the boss of the Contrate, secures the steam dome to the boiler top by means of a Collar placed on the Rod beneath the boiler. The Double Brackets 87 are for the purpose of securing the outside steam pipes 74 to the sides of the smoke-box. The front Hub Disc that represents the smoke-box door is filled in by a number of $2\frac{1}{2}$″ Triangular Plates.

The side handrails (8″ Rods) are carried by Handrail Supports secured to the front portion of the boiler shell, the front rail (an 8″ Rod) being curved over the smoke-box front and secured to the side handrails by Couplings.

The top of the fire-box is composed of two $5\frac{1}{2}'' \times 3\frac{1}{2}''$ Flat Plates, and each side of the two $5\frac{1}{2}'' \times 3\frac{1}{2}''$ Flat Plates overlapped eight holes in the direction of their length. Each side is joined to the top of the fire-box by means of the $4\frac{1}{2}$″ Angle Girder 88 and the $2\frac{1}{2}$″ Angle Girder 89. The back plate (Figs. 8 and 9) is composed of two $5\frac{1}{2}'' \times 3\frac{1}{2}''$ Flat Plates that overlap one another by three holes; it is secured to $3\frac{1}{2}$″ Angle Girders which are bolted to the rear edges of the sides of the fire-box. Two $\frac{3}{8}$″ Bolts 90 (shanks outward) take the place of ordinary bolts at the two top corners of the back plate (Fig. 8). Two similar Bolts 91 are attached to the two lower corners of the back plate (Figs. 8 and 9).

The fire-box is attached to the boiler shell by the projecting portions of the three $12\frac{1}{2}$″ Strips 84, only two of which are shown in Fig. 9, the other being on the opposite side of the fire-box.

Construction of the Boiler Fittings

Most of the boiler fittings are shown clearly in Fig. 8. The "injector" 92 consists of an Octagonal Coupling that is attached by an ordinary bolt to the fire-box back plate. The bolt is passed

Special Instruction Leaflet

Full instructions for building the Meccano Baltic Tank Locomotive, together with a large number of sectional illustrations in half-tone that make every detail clear, are contained in the Special Instruction Leaflet No. 15. The leaflet deals at greater length with several portions of the model than has been possible in the Magazine articles, and will prove valuable not only to model-builders, but to everyone interested in locomotive construction generally. The leaflet may be obtained from any Meccano dealer price 3d. or direct from Meccano Ltd., Binns Road, Old Swan, Liverpool, price 3d. post free. (Overseas 4d., Canada 8 cents.)

through a hole in the Plate and inserted in the tapped centre hole of the Coupling. A Threaded Pin is inserted in the remaining tapped centre hole of the Coupling and a ½" fast Pulley secured to its shank. A 3½" Crank Handle represents the intake pipe to the injector from the tanks.

The water gauges 93 are represented by 1½" Rods held in Hand-rail Supports that are secured to the back plate. Between the two water gauges is placed the "regulator" 94. This consists of a Crank with a 2½" Strip bolted to it, a Threaded Pin forming a handle. The Crank is secured to the end of a 6½" Rod 95 (Fig. 9) that is journalled both in the back plate and in a 5½" × ½" Double Angle Strip which is placed across the fire-box near the front end. A Crank 96 is secured to the Rod 95 in a position vertically above the Motor switch, to which it is connected pivotally by means of two 2½" Strips overlapped two holes. (The bottom of one of these Strips may be seen below the back plate in Fig. 8).

The fire-hole door 97 is represented by a 1½" Flat Girder which is mounted on two Hinges secured to the back plate. The Hinges are spaced away from the back plate by means of two Washers on the shanks of each of the retaining bolts.

The "sight feed lubricator" 98 consists essentially of two Couplings that are secured to the back plate by ordinary bolts inserted in the tapped holes of the Couplings. Short lengths of Spring Cord—to represent the pipes that convey oil to the working parts of the engine—are inserted in the end transverse holes of the Couplings, and retained therein by bolts.

The "blower valve handle" 99 consists of a Threaded Pin, which is inserted in the set-screw holes of a Collar and secured on the end of a 4½" Rod. This 4½" Rod is joined to the Coupling 100 that represents the blower valve by means of two 11½" Rods running along the side of the boiler.

The whistles 101 (low and high note !) are represented by Collars; the high note whistle consists of two Collars on a ¾" Bolt, which is secured to the top of the fire-box by two nuts, whilst the low note whistle is represented by two Collars fixed a short distance apart on a 1½" Rod; the Rod is held in place by a Collar beneath the fire-box top. The two Ross pop safety valves are represented by two pairs of ½" loose Pulleys mounted at each end of a base composed of three 1½" Strips laid one on top of each other; ¾" Bolts are passed through the Pulleys and 1½" Strips and secured to the fire-box top by nuts placed underneath the plate.

The two Spring Buffers that may be seen mounted on the smoke-box just behind the funnel are intended to represent the header vacuum release valves.

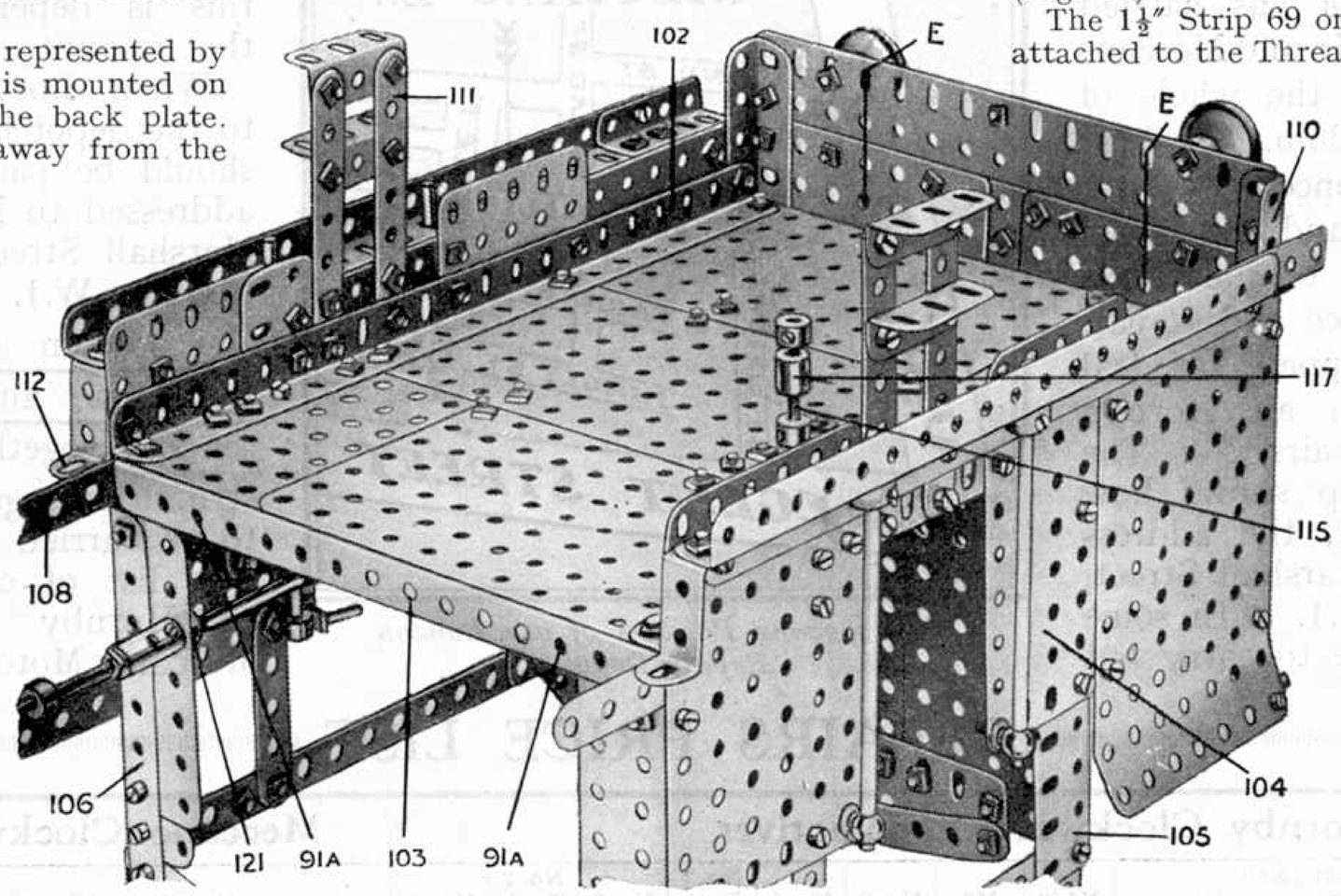


Fig. 10. Cab of Locomotive as seen from below. The rear buffer beam, steps and control spindles are shown clearly in this illustration

Assembly of the Model Units ; Attaching the Footplating

The first part to be attached to the chassis (Fig. 7) is the front footplating and buffer beam unit (Fig. 5).

First remove the Flat Brackets 21 from the smoke-box saddle (Fig. 7) and secure the footplate unit in place so that the holes 71a in the Angle Girders 4 register with those in the 4½" Angle Girder that is bolted to the underside of the Angle Girder 71 (Fig. 5). The Angle Brackets 20 (Fig. 7) must coincide also with the holes 20a (Fig. 5) so that bolts may be inserted in them. Bolts are also inserted in the holes A, B, and passed through corresponding holes in the Angle Girders beneath. The unit will now be found to be rigidly secured to the main frames and the Flat Brackets may be replaced on the smoke-box saddle.

Each expansion link 51 (Fig. 7) may be now attached to the lowest hole of the expansion link bracket 52 by means of the lock-nutted bolt that forms the pivot of the link. The expansion links are now able to rock about their pivots by the motion of the return crank 50.

Erecting the Cab Unit on the Main Frames

The cab unit (Figs. 6 and 10) is attached to the rear end of the main frame by means of bolts that are passed through the holes D (Fig. 6) on each side to the Angle Girders 3 beneath. The rear buffer beam is secured to the 2½" Angle Girders 17a (Fig. 1), by four bolts that are inserted through each of the lines of holes E (Fig. 10).

The 1½" Strip 69 on the Crank 68 (Fig. 1) is attached to the Threaded Boss 117 (Fig. 10) by means of a Bolt that is prevented from working loose by a nut locked against the Boss. In inserting the bolt in the transverse tapped hole of the Threaded Boss, care must be taken to see that the Bolt does not nip the Screwed Rod 115, for the Threaded Boss must be quite free on the latter, of course.

The 12½" Strip (see Fig. 7) is connected to the Threaded Boss 120 on the screwed Rod 119 (Fig. 6) in a similar manner.

Placing the Boiler on the Main Frames

The boiler and fire-box (Fig. 9) may now be lowered into position on to the main frames, being attached to the Angle Girder 103 (Fig. 10) by means of the ⅜" Bolts 91 projecting from the fire-box back plate. The shanks of the bolts are passed through the holes 91a in the Girder 103, and secured by nuts.

The smoke-box end of the boiler is secured to the saddle by means of the four bolts 21a (Fig. 9), the shanks of which project through the holes of the Flat Brackets 21 (Fig. 7). The ends of the steam pipes 74 (Fig. 5) are attached to the Double Brackets 87 (Fig. 9) by 1" Threaded Rods and are held in place by nuts.

The ⅜" Bolts 90 (Fig. 8) pass through the slots in the Slotted Strips 107 (Fig. 6). A 5½" Curved Strip is now placed on the bolts 90 and nuts on the shanks of the latter serve to retain the Curved Strip. The cab roof may now be attached to the Hinges 113.

The leading and trailing bogies may be attached to their respective bogie pin stretchers 14 and 15. The bogie pins 129 (Fig. 4) are inserted in the centre hole of the stretcher and retained in position by means of Collars.

Two springs (part No. 43) should be attached by means of a ⅜" Bolt to one of the 4½" Angle Girders forming the ends of the bogie frames, their other ends being attached to the main frames on each side.

The side tanks are secured to the 3½" Strips 108 (Figs. 6 and 10) by means of nuts and bolts. The 1" Reversed Angle Brackets 112 and the ½" Reversed Angle Brackets on the ends of the Girders 70 (Fig. 5) are then bolted to the running boards. The tanks are further secured to the sides of the firebox and the Plates 72 by Angle Brackets 126 and 127. By placing a Meccano 6-volt Accumulator in the cab, the model becomes entirely self-propelled.

List of Parts Required to Build the Model

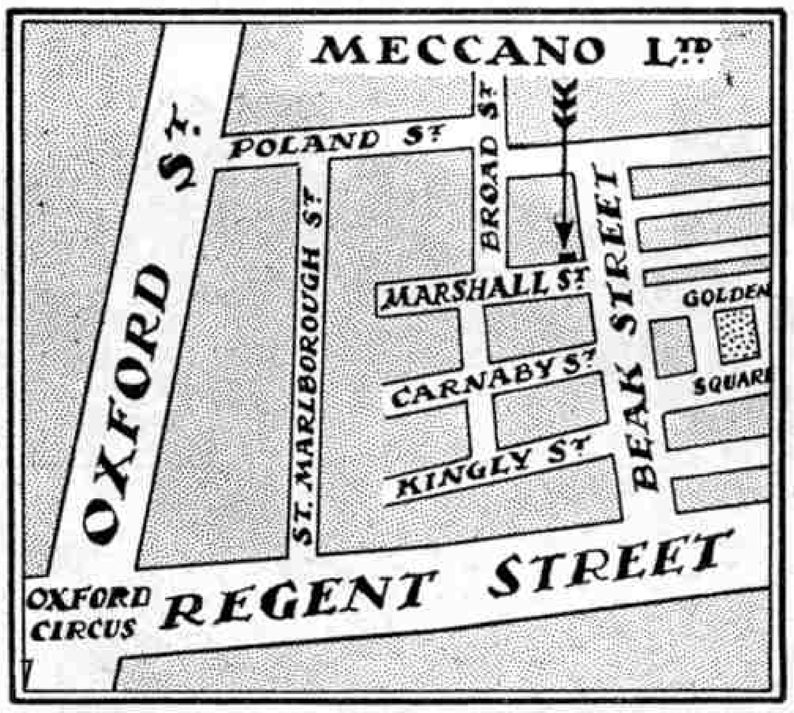
55 of	No.	1	4 of	No.	8	29 of	No.	12	7 of	No.	18b	903 of	No.	37	2 of	No.	55a	9 of	No.	76	2 of	No.	103e	2 of	No.	120
2	„ „	1a	12	„ „	8a	1	„ „	12a	1	„ „	19s	22	„ „	37a	8	„ „	58	2	„ „	77	6	„ „	103f	2	„ „	124
6	„ „	1b	8	„ „	8b	2	„ „	13	2	„ „	20	56	„ „	38	73	„ „	59	1	„ „	80a	2	„ „	103g	5	„ „	125
9	„ „	2	9	„ „	9	4	„ „	13a	2	„ „	20b	6	„ „	43	9	„ „	62	1	„ „	81	5	„ „	103h	16	„ „	133
16	„ „	2a	25	„ „	9a	6	„ „	14	8	„ „	22	1	„ „	45	16	„ „	62b	8	„ „	82	6	„ „	103k	14	„ „	136
8	„ „	3	4	„ „	9b	1	„ „	15	8	„ „	23	2	„ „	48	17	„ „	63	2	„ „	89	8	„ „	109	9	„ „	137
1	„ „	4	4	„ „	9c	10	„ „	15a	1	„ „	23a	12	„ „	48a	1	„ „	63a	10	„ „	90	11	„ „	111	1	„ „	139
17	„ „	5	4	„ „	9d	1	„ „	16	15	„ „	24	6	„ „	48b	2	„ „	63b	8	„ „	90a	18	„ „	111c	1	„ „	139a
7	„ „	6	4	„ „	9e	1	„ „	16a	1	„ „	25	1	„ „	48d	2	„ „	63c	8	„ „	103	4	„ „	114	6	„ „	146
12	„ „	6a	6	„ „	9f	9	„ „	16b	2	„ „	26	10	„ „	50a	4	„ „	64	2	„ „	103a	6	„ „	115	6	„ „	147b
4	„ „	7	24	„ „	10	3	„ „	17	2	„ „	27a	28	„ „	52a	2	„ „	67	2	„ „	103b	2	„ „	116a	1	Electric	
4	„ „	7a	10	„ „	11	11	„ „	18a	1	„ „	27b	1	„ „	53	9	„ „	70	2	„ „	103c	11	„ „	118		Motor	
									1	„ „	28	13	„ „	53a	2	„ „	72	6	„ „	103d						

Our London Repair Depot

is at

5-6 Marshall Street • Golden Square • London W.1

Hitherto our Service Department at Liverpool has carried out all Hornby Train and Meccano Motor repairs for the whole of the United Kingdom. Now, for the convenience of boys living in London and the Home Counties, we have established a new London Service and Repair depot, fully equipped to deal expeditiously with all Hornby and Meccano repairs. The accompanying map shows how to find the depot, the address of which is 5-6, Marshall Street, Golden Square, W.1. In some cases it is possible to carry out repairs in an hour or two, but this is dependent entirely on the amount of work necessary.



Plan showing Position of our London Repair Depot

When Locomotives are sent to the depot by parcel post they should be packed carefully and addressed to Meccano Ltd., 5-6, Marshall Street, Golden Square, London, W.1. A note should be enclosed in the parcel giving the name and address of the sender, together with full instructions regarding the repairs to be carried out.

A list of charges for repairs to Hornby Locomotives and Meccano Motors is given below.

REPAIRS PRICE LIST

Hornby Clockwork Locomotives

New Parts Fitted, and Renovations	M1/2	M3	No. 0	No. 1	No. 1 Tank	No. 2	No. 2 Tank	No. 3
Gear Wheels								
No. 1 Gear Wheel	—	2/11	2/11	2/11	2/11	3/7	3/7	3/7
Nos. 1 and 2 Gear Wheels	—	3/2	3/2	3/2	3/2	3/11	3/11	4/–
Nos. 1, 2 and 3 Gear Wheels	—	3/4	3/4	3/4	3/4	4/3	4/3	4/4
Nos. 1, 2, 3 and 4 Gear Wheels	—	3/6	3/6	3/6	3/6	4/6	4/6	4/7
No. 2 Gear Wheel	—	2/6	2/6	2/6	2/6	3/2	3/2	3/3
Nos. 2 and 3 Gear Wheels	—	2/8	2/8	2/8	2/8	3/6	3/6	3/7
Nos. 2, 3 and 4 Gear Wheels	—	2/10	2/10	2/10	2/10	3/9	3/9	3/10
No. 2 Gear and Reversing Pinion	—	2/8	2/8	2/8	2/8	3/4	3/4	3/5
No. 3 Gear Wheel	—	2/5	2/5	2/5	2/5	3/2	3/2	3/2
Nos. 3 and 4 Gear Wheels	—	2/7	2/7	2/7	2/7	3/5	3/5	3/5
Housings								
*New Housings	1/9	2/6	3/6	4/–	4/–	6/6	7/–	11/–
Enamelling Housings	—	—	3/1	3/4	3/4	5/–	5/8	7/4
Additional charges for enamelling Housings in cases where repairs are also effected	—	—	1/10	2/1	2/1	3/8	4/4	6/–
Miscellaneous								
Mainspring	-/11	1/7	1/7	1/7	1/7	1/10	1/10	2/–
Set of Motor Wheels	—	1/8	1/8	1/8	1/8	2/3	2/3	2/3
Winding Shaft	—	2/4	2/4	2/4	2/4	2/11	2/11	2/11
4 Bogie Wheels	—	—	—	—	—	1/5	1/5	1/5
Governor	—	2/5	2/5	2/5	2/5	3/2	3/2	3/2

*In cases where new housings are fitted in addition to extensive mechanical repairs they will be charged at a reduced rate.

Meccano Clockwork Motor

New Parts Fitted	Clockwork Motor
Gear Wheels	
No. 1 Gear Wheel	1/10
Nos. 1 and 2 Gear Wheels	2/–
Nos. 1, 2 and 3 Gear Wheels	2/2
Nos 1, 2, 3 and 4 Gear Wheels	2/4
No. 2 Gear Wheel	1/3
Nos. 2 and 3 Gear Wheels	1/5
Nos. 2, 3 and 4 Gear Wheels	1/7
No. 2 Gear and Reversing Pinion	1/4
No. 3 Gear Wheel	1/3
Nos. 3 and 4 Gear Wheels	1/5
Miscellaneous	
Mainspring	1/7
Winding Shaft	1/2
Governor	1/5
Re-assembling only	1/–

Hornby Electric Locomotives

New Parts Fitted	Low-volt Locomotives	High-volt Locomotives
Brushes (2), Springs (2)	2/–	1/11
Brushes, Springs and Commutator	4/1	4/5
Brushes, Springs and Shoes	3/11	3/10
Brushes, Springs, Shoes and Commutator	4/3	4/7
Armature	5/8	6/1
Armature, Brushes, Springs	6/4	6/8
Armature, Brushes, Springs, Shoes	6/6	6/10
Field Coil	4/6	4/10
Sideplates (2)	5/7	4/5
Sideplates, Brushes and Springs	6/3	5/–
Sideplates, Brushes, Springs and Shoes	6/5	5/2
Collector Shoe Complete	3/10	3/10

Meccano Electric Motors

New Parts Fitted	Low-volt Motor No. 1	High-volt Electric Motor No. 2
Brushes (2), Springs (2)	1/9	1/9
Brushes, Springs and Commutator	3/3	3/7
Armature	3/7	6/11
Armature, Brushes, Springs	4/2	7/6
Field Coil	3/5	3/9
Sideplates (2)	2/8	2/8
Sideplates, Brushes and Springs	3/3	3/3

MECCANO LIMITED
Old Swan
LIVERPOOL

In this page, month by month, we reply to suggestions regarding improvements or additions to the Meccano system. We receive many hundreds of these suggestions every week, and consequently we are able to publish only ideas that show particular interest or ingenuity. Suggestions submitted for consideration in this section must be written on a separate sheet of paper and the name and address of the sender must appear on each sheet used. Envelopes should be addressed to "Suggestions," Meccano Ltd., Binns Road, Old Swan, Liverpool.

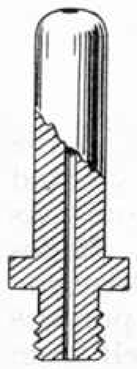


Fig. 1

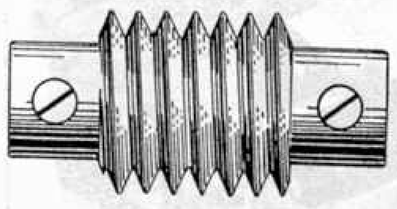
IMPROVED THREADED PIN.—Your suggested alteration to the Threaded Pin (part No. 115) is distinctly interesting. As will be seen in the sketch (Fig. 1) a small hole would be threaded through the entire length of the part so that it could be used in the construction of a lubricator, Fig. 2 showing a built-up lubricator in section. The lubricator would function on the "syphon wick" principle and would comprise a Chimney Adaptor A secured to a standard Meccano boss B by the special pin, which would be screwed into the tapped hole of the boss. A length of thin wick C would be pushed into the hole in the pin, its other end dipping into the lubricating oil D contained in the Chimney Adaptor. In this way oil would be drawn to the base of the Threaded Pin and would fall on to the rotating shaft, thus providing the necessary lubricating action. Your suggestion is certainly interesting, but in view of the difficulty and expense involved in altering the existing Pin, we are unable to consider carrying out your idea. A syphon wick lubricator using purely standard parts was described in the "Suggestions Section" for December, 1928. (*Reply to D. McDowell, Sheerness, Kent*).

GROOVED RODS.—The diameter of the standard Meccano Axle Rod does not permit a groove to be cut in it without a great loss of strength. The functions of a grooved rod can, in many cases, be duplicated by the use of the Meccano Socket Coupling (part No. 171). (*Reply to C. Boissière, Nantes, Loire, France*).

MOTOR FITTINGS.—We agree that a miniature head-lamp reflector, that could be fitted with a Meccano Electric Bulb, would add a touch of realism to the Motor Chassis and model motor cars generally. We are considering this idea, and meanwhile would suggest that you use a Meccano Lamp (part No. 311) secured in a Meccano Lamp Holder (part No. 310) bolted to the front of your model. (*Reply to B. Eisenschitz, Le Rayol, Var, France*).

MECCANO FLAG.—We note you suggest the introduction of a miniature Meccano pennant, fitted with a screwed standard for attachment to models. We would remind you, however, that an excellent Meccano flag coloured in red and green is manufactured by the "Q" Accessories Company and is just the thing for fitting to the top of the Meccano Eiffel Tower or other models. (*Reply to W. Bache, Stourbridge, and S. Kingston, Bedford*).

IMPROVED WORM.—The advantages to be gained from fitting additional bosses to the standard Meccano Worm as shown in the sketch are altogether outweighed by the loss of adaptability that would result when the article was employed for its original function.

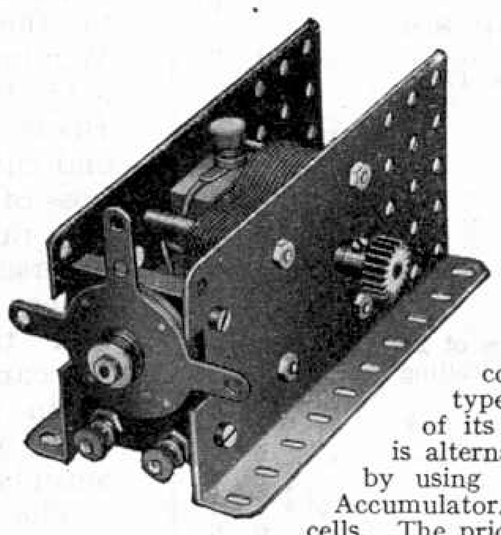


We agree that when manufactured in this manner, the part would fulfil the dual function of a Worm and coupling for two Rods but it could only occasionally be used in this manner to advantage. (*Reply to R. S. Garner, Portsmouth, and J. Petch, Bangor, Co. Down*).

1" CRANK.—As previously mentioned in these pages the uses of a 1" strip fitted with a boss are already covered by the Double Arm Crank (part No. 62b). (*Reply to E. Dabbene, Turin, Italy*).

IMPROVED CHANNEL BEARING.—Your suggestion that the width of the Channel Bearing (part No. 160), which is at present ½", should be increased to 1" so that wheels, etc., could be placed between the upright portions, is interesting but, we consider, hardly necessary. The original function of this part is to provide a reinforced bearing for a short shaft, and where a wider bearing is required, two Girder Brackets (part No. 161) bolted to the base plate of a model so that their upright portions are 1" apart, can be used as a substitute for your suggested article. (*Reply to A. Maclure, Glasgow, W.2, and T. Massey, Adelaide, S. Australia*).

The New Meccano 6-volt Motor



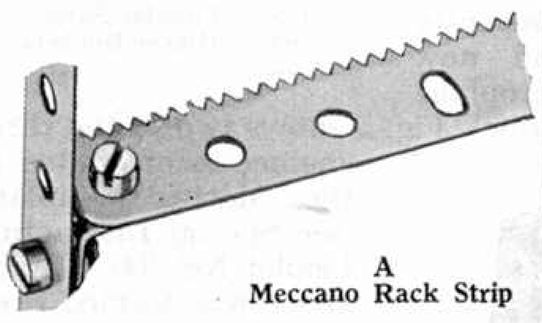
The Meccano Electric Motor has recently been re-designed, and it now works from a current of six volts instead of four. The improved Motor, shown in the accompanying illustration, is identical in size and external details to the old 4-volt Motor, the winding only being changed. It is of much greater all-round efficiency, and although it runs from a higher voltage, the actual current consumption is smaller. It consumes from approximately 1 to 1.5 amperes, according to the load; hence the wear and tear on the brushes is reduced, and the accumulator will last longer for each charge. Finally, the 6-volt Motor is considerably more powerful than even the 4-volt type, which was by far the strongest electric motor of its kind obtainable. Where the house electric supply is alternating current, the 6-volt Motor may be run from it by using a Meccano Transformer, thus dispensing with the Accumulator. The Motor will not run satisfactorily from dry cells. The price of the Motor is not changed (15/6 each).

Those boys who possess Meccano 4-volt Motors can have them converted for 6-volt working at a cost of 4/– (including postage each way). They should hand their Motors to their dealers, or forward them, together with a remittance of 3/6, direct to Service Department, Meccano Ltd., Binns Road, Old Swan, Liverpool.

New Meccano Parts

No. 58A, Coupling Screw for Spring Cord. This part is designed for coupling the ends of a length of Spring Cord together so as to form an endless belt, etc. It is 3/32" long and is provided with a thread of such a pitch that when it is screwed into the end of the Spring Cord the thread engages with the turns of the spring. It forms a very neat connection that will ride smoothly round the grooves of the Meccano Pulleys. Price, 6d. per doz.

No. 110A, 6½" Rack Strip. Used in conjunction with a Meccano Pinion or Gear Wheel, this part may be employed to convert rotary movement to rectilinear movement or vice versa. It is similar, except in length, to part No. 110. Price 3d. each.



A Meccano Rack Strip

NEW GEARED RACE.—Your suggestion regarding a special ball race fitted with standard Meccano gear teeth for use in place of the sprocket toothed race fitted to the existing Ball Bearng Unit (part No. 168), is interesting. An excellent substitute for your article can, however, be improvised from a Meccano 3½" diam. Gear Wheel and this will be found to function quite as well as a special race member (see Standard Mechanisms Manual, detail No. 144). (*Reply to J. Stanhope-Remler, London, S.W.6*).

NEW TYRES.—You will be pleased to hear that 1" and 1½" diameter Rubber Dunlop Tyres are now available. These tyres are similar in design to the existing Meccano 2" and 3" diam. Dunlop Tyres, having moulded "non-slip" treads, and tapered rims for fitting to the Meccano 1" and 1½" Pulley Wheels. The price of the 1" diam. Tyre is 3d., while the 1½" diam. variety cost 4d. each. (*Reply to R. Heatherington, Salford, Bristol*).

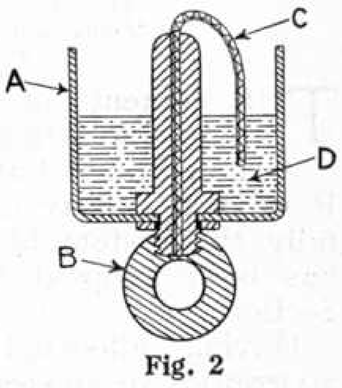


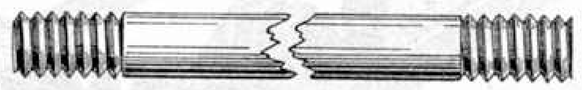
Fig. 2

IMPROVEMENT TO CLOCKWORK MOTOR.—As you point out, the arrangement of the winding mechanism in the existing Clockwork Motor does not permit the spring to be wound while the driving shaft is rotating. By securing the outer end of the spring to the face of a drum, and attaching the pawls of the ratchet gear to the frame of the Motor (the ratchet wheel itself being secured to the drum) it would be possible to wind the spring while the gearing was in motion. This type of winding gear would, however, be costly to manufacture, and would be put out of action more readily than the existing mechanism. The question of making this alteration is, however, receiving our attention. (*Reply to G. R. Nisbet, Melbourne, Australia*).

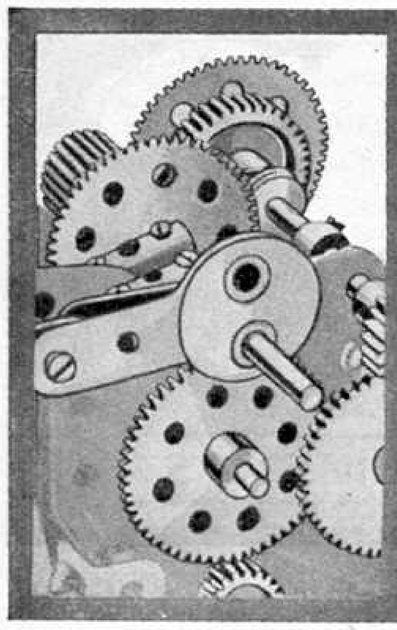
STEAM ENGINE FLYWHEEL.—We were interested in your idea that a groove should be cut in the rim of the flywheel fitted to the crankshaft of the new Meccano Steam Engine. This would enable the flywheel to be used as a pulley for transmitting motion to small models through a light cord drive. Although high speeds could be obtained in this way, the power available would not, of course, be great, and for this reason we consider it a better plan to fasten a Pulley Wheel to the secondary geared shaft incorporated in the Steam Engine when a cord drive is required. A high speed drive can of course quite easily be obtained by employing "step-up" gears mounted on shafts journally in the perforated sides of the engine base-plate. (*Reply to J. Catford, Cheltenham*).

INNER TUBES.—We have received a number of suggestions recently that the Dunlop Tyres should be manufactured in a similar manner to tyres used in actual practice, i.e. with inner tubes, valves, etc. We would remind those readers, however, that while it might be possible to carry out this suggestion in the case of the 3" Tyre, it would be quite impossible with the smaller diameter articles. The cost of fitting the 3" Tyres in this way would be tremendous owing to the minute operations involved, and the idea is altogether impracticable. (*Reply to J. Booth, Cladwell Heath; R. Headley, Warrington; T. J. Ripley, Stoke; T. S. Price, Didsbury, Manchester, and others*).

NEW TYPE ROD.—There are doubtless a number of duties for axle rods tapped with standard thread for a short distance at each end (see accompanying sketch). These parts would prove particularly useful in structural work where they could be employed to advantage as tie members. Rods of this

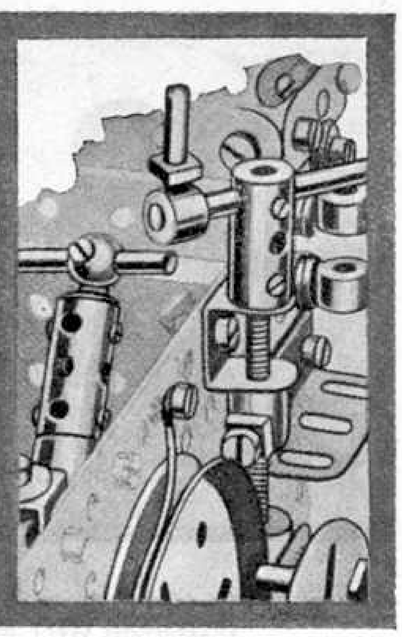


type could further be applied to certain mechanisms where a plain and threaded surface is required in one member. We are considering the introduction of a range of rods of this type. (*Reply to F. Cardwell, Liverpool, and R. E. Foster, Bath*).



HOW TO USE Meccano Parts

X.—Special Accessories (Class P)



For the purpose of this series of articles we have grouped all the Meccano parts into two main sections, termed the Structural and Mechanical Sections, and these sections have been further divided into a number of separate classes. The complete grouping is as follows. Structural Section: Class A, Strips; Class B, Girders; Class C, Brackets, Trunnions, etc.; Class D, Plates, Boilers, etc.; Class E, Nuts and Bolts, Tools and Literature. Mechanical Section: Class M, Rods, Cranks and Couplings; Class N, Wheels, Pulleys, Bearings, etc.; Class O, Gears and Toothed Parts; Class P, Special Accessories; Class Q, Miscellaneous Mechanical Parts; Class T, Electrical Parts; Class X, Motors, Accumulators, etc.

THE contents of the various classes into which the Meccano parts have been grouped are indicated in the introductory note above, but before describing the parts included in Class P we will endeavour to explain more fully the system of classification that has been adopted in the Mechanical Section.

Having allocated the appropriate accessories to classes M, N, O, T, and X it was found that there still remained a large number of unclassified parts. Of these a certain proportion possess characteristics quite different to the rest; they were therefore collected together under "Class P, Special Accessories," while the remainder were labelled "Class Q, Miscellaneous Mechanical Parts."

By "Special Accessories" we mean those parts that are designed for special purposes, such as Shuttles (for looms), rubber tyres (for fitting to Pulley Wheels, to represent motor car wheels), Signal Arms, etc. Under "Miscellaneous Mechanical Parts" are grouped all those parts that are used in the construction of gear boxes and other working features of a model and yet cannot be grouped under Classes M, N, or O. It must here be mentioned, however, that although the Special Accessories have been introduced for particular purposes, they have been used by Meccano boys for other very different functions, some of which are referred to in these pages. Class P parts not described in this article will be dealt with next month.

Parts in Class P: Special Accessories

Part No.		Prices	
		s.	d.
41	Propeller Blades ... ... per pair	0	4
61	Windmill Sails ... ... 4 for	0	6
66	Weights, 50 grammes ... ... each	1	0
67	„ 25 „ ... ... „	1	0
101	Healds, for Looms ... ... doz.	0	9
104	Shuttles, for Looms ... ... each	5	0
106	Wood Rollers, complete with 4½″ Rod and 2 Collars ... ... „	1	6
106a	Sand Rollers, complete with 4½″ Rod and 2 Collars ... ... „	1	9
107	Tables for Designing Machines, Complete with Bush Wheel ... ... „	1	6
114	Hinges ... ... per pair	0	4
117	Steel Balls, ⅜″ Diam. ... ... doz.	0	6
120	Buffers ... ... each	0	2
120a	Spring Buffers ... ... per pair	0	8
122	Miniature Loaded Sacks ... ... each	0	2
131	Dredger Bucket ... ... ½ doz.	1	0
135	Theodolite Protractors ... ... each	0	3
138	Ship's Funnels ... ... „	0	3
138a-z	„ „ Raked; A series of 25 funnels in colours to represent leading shipping lines ... ... „	0	9
141	Wire Lines (for suspending Clock Weights) ... ... „	0	9
142	Rubber Rings, to fit 3″ rim ... ... „	0	3
142a	Dunlop Tyre to fit 2″ diam. rim... ... set of 4	1	6
142b	„ „ „ 3″ „ „ ... ... each	0	6
142c	„ „ „ 1″ „ „ ... ... „	0	3
142d	„ „ „ 1½″ „ „ ... ... „	0	4
149	Collecting Shoes, for Electric Locos ... „	1	6
150	Crane Grabs ... ... „	0	7
155	Rubber Rings, ⅝″ int. diam. (will fit 1″ Pulley) ... ... „	0	1
156	Pointers, 2½″ overall, with boss ... ... „	0	4
157	Fans, 2″ diam. with boss ... ... „	0	4
158a	Signal Arm, Home ... ... „	0	5
158b	„ „ Distant ... ... „	0	5
159	Circular Saws ... ... „	1	0
169	Digger Buckets ... ... „	2	0

Fig. 3 shows two of the three engines incorporated in the Meccano Biplane (see Special Instruction Leaflet No. 34). Each airscrew is formed from two Propeller Blades, and it will be observed that each pair of blades is bolted to a Double Arm Crank, the boss of which serves to secure the complete airscrew to the engine shaft. The hub end of each blade is rounded so that it partially encloses the boss; hence one bolt is sufficient to hold the blade perfectly rigid. If a Double Arm Crank is not available the blades may of course be bolted to a Bush Wheel or similar part.

The broader parts of the blades are turned at an angle to the plane of rotation so that a considerable current of air is created by the airscrew when in motion. As a matter of fact the Propeller Blades have been employed in a Meccano electric fan, although for such a purpose it is better to shape the fan itself from a sheet of tin so that the blades may be as broad as possible. A very interesting small model making use of the Propeller Blades is the "helicopter" described in the 1929 "Meccano Book of New Models."

In Model No. 4.23 (Windmill Scare) in the 4-7 Instruction Manual four Windmill Sails are shown secured to a 1½″ Pulley Wheel. Like the Propeller Blade, the Windmill Sail has its hub end cut out so that it will fit round the boss of a wheel or, as in this case, round the raised lip on the wheel on the reverse side to the boss. Amongst other adaptations of the Windmill Sail that have been suggested by Meccano boys are its use to represent cabin sides in model ships (complete with windows!) and wings for small aeroplanes.

The Weights (parts Nos. 66 and 67) are supplied specially for the benefit of Meccano boys who wish to carry out delicate scientific experiments, wherein perfectly accurate weights are essential. For example, they are used in connection with the lever and pulley demonstration models that were described in detail in the 1928 Standard Mechanisms Manual. In these models the properties of various types of levers and pulley blocks were illustrated, and in order to obtain correct measurements of their mechanical efficiency, small weights of absolute accuracy were necessary.

The Weights also find numerous other applications in ordinary model-building. Fig. 1 shows a portion of a device for measuring the movement of a beam that is subjected to a bending stress. In order to measure the strength of the beam correctly, the exact amount of the weight applied must be known. In the illustration five 50-gramme Weights 3 are attached to the centre of the beam by means of a Scientific Hook.

The 25-gramme Weight 4 serves to counterbalance

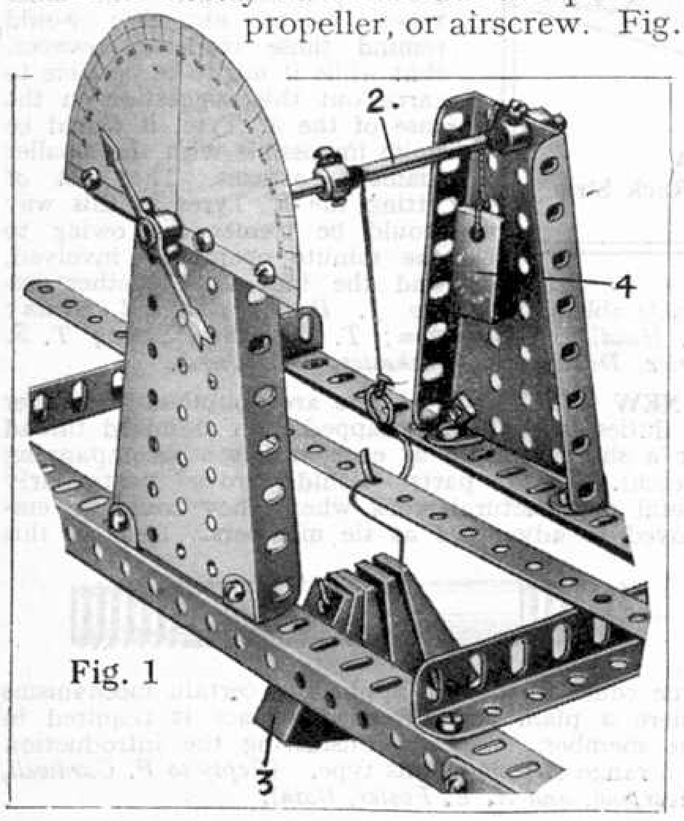


Fig. 1

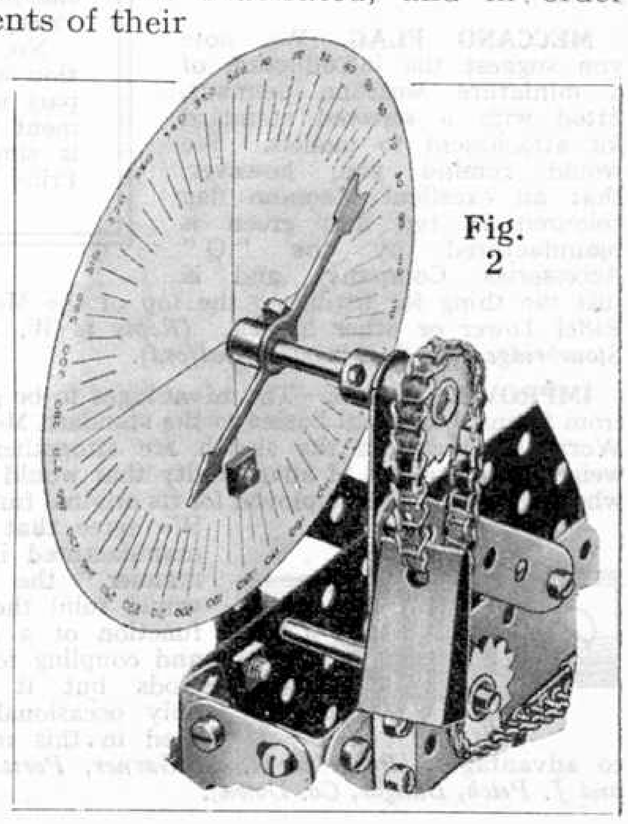


Fig. 2

the weight of the Pointer, so that the latter always returns to the "zero" position when the load is removed from the beam. In Fig. 2 a 25-gramme Weight is used for a similar purpose, i.e. for returning a Pointer to "zero," or neutral, after deflection. Of course, in these two last-mentioned cases it is not essential that the weights should be of great accuracy or even of any particular amount, and if a Meccano boy does not already possess these parts he can use home-made weights, or a Meccano Wheel or two, in their place. This remark applies to several models shown in the Meccano literature.

In addition to the use for which it is specially designed, i.e. as a heald in the Meccano Loom (see Instruction Leaflet No. 16), part No. 101 is frequently employed as a tie in bracing various Meccano structures. In the Meccano Three-engine Biplane (Instruction Leaflet No. 34) Healds are used as the diagonal ties between each pair of upright wing supports. A portion of a pair of these supports, with the Healds in position at 25, can be seen in Fig. 5. Another important use for Healds is found in the Meccano Motor Chassis, where they are employed as the means of connection between the hand brake lever and the brake mechanism on the rear wheels.

Part No. 104, Shuttle, is produced specially for use in the model Loom. It is illustrated and its functions fully explained in the Instruction Leaflet dealing with that model.

In addition to their functions as the take-up rollers in the Loom, the Wood and Sand Rollers (Nos. 106 and 106a), are frequently used as winding drums in Meccano cranes, etc. Both Rollers are provided at each end with a circular recess, to receive a Collar or wheel boss, and with a slot to receive the set-screw inserted in the boss. Each is supplied complete with two Collars secured to a $4\frac{1}{2}''$ Axle Rod. The Wood Roller also has a groove along one side, the object of which is to enable the woven material in the Loom to be secured by gripping it under a short Rod dropped into this slot. An ideal winding drum may be formed from the Wood Roller by adding a Bush Wheel at either end as shown at 45 in Fig. 4. A drum so formed has a large capacity.

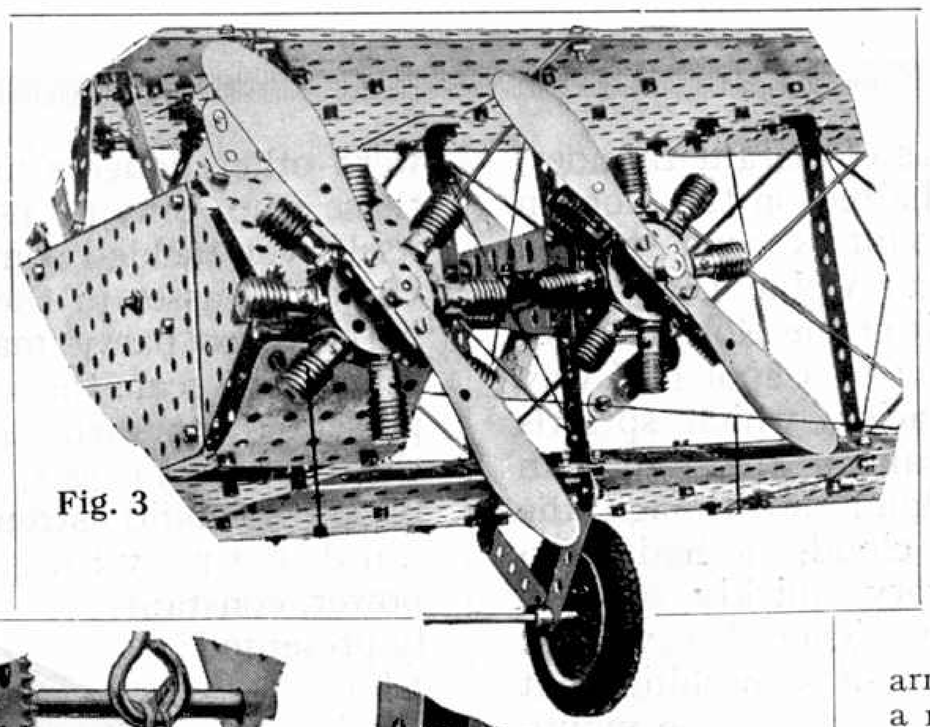


Fig. 3

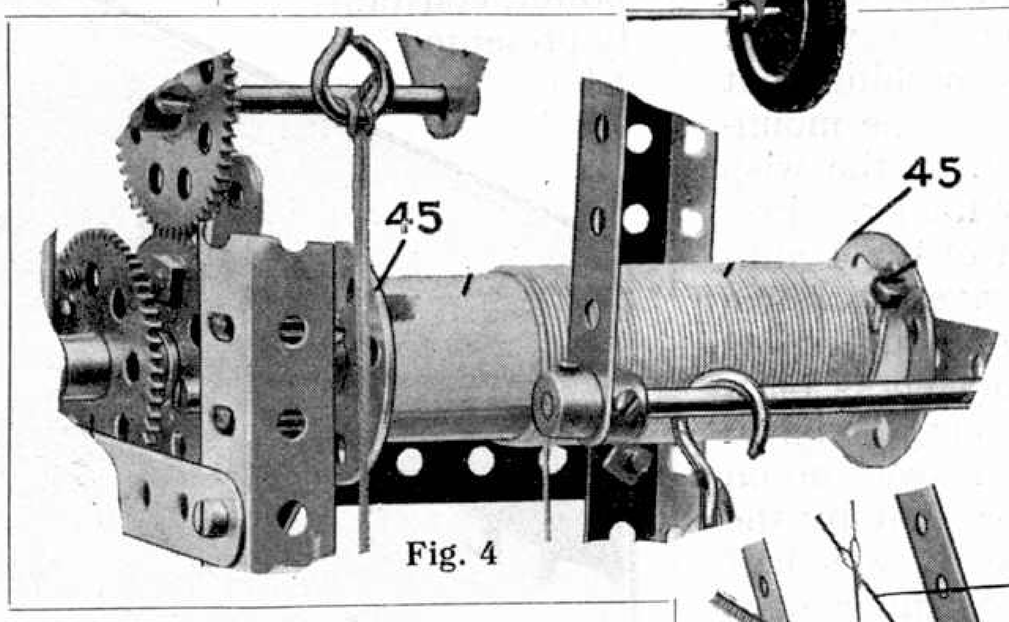


Fig. 4

The Sand Roller differs from the Wood Roller in that it is encircled by a sheet of tin that is specially burred so as to grip the woven material in the Loom as it passes beneath it and is wound on to the Wood Roller.

Part No. 107 is supplied specially for use with the Meccanograph (see Instruction Leaflet No. 13) wherein it is used to hold the paper whilst the design is being drawn by the writing arm. It is $6\frac{1}{2}''$ square, of smooth polished wood, and is supplied complete with a Bush Wheel screwed to its under side, by means of which it is secured to the vertical rotating spindle in the model. The part is also very useful as a fixed base for small models.

A Meccano Hinge is shown in Fig. 5, where it is seen connecting one end of the aileron to the main wing in the Meccano Biplane. This part is invaluable for mounting doors and similar hinged parts in Meccano models. It is also frequently used in place of lock-nutted bolts, etc., in making pivotal connections between any two parts of a model.

The Steel Balls (part No. 117) are intended for use in building up ball bearings for swivelling structures. A typical built-up ball bearing unit is described in the Standard Mechanisms Manual (see detail No. 134), and on reference to this it will be found that twenty-one Steel Balls are placed round the circumference of a Wheel Flange that is bolted to a 3″ Pulley Wheel, while a further 3″ Pulley, which is bolted to the swivelling superstructure, rests upon the Balls. With this arrangement it is possible to rotate heavy structures easily and smoothly about a central pivot. The Steel Balls are also used in model-building for ballast purposes and for driving "gravity wheels." In the latter case the Balls are arranged to drop one at a time on to the blades of a kind of water-wheel, and the weight of the Balls causes the wheel to rotate, just as the force of the water operates the actual water-wheel.

The Miniature Loaded Sacks add a very realistic touch to Meccano models of cranes, lorries, conveyors and other types of goods-handling machinery. They may also be used with advantage in connection with Hornby goods trains. They are filled with sawdust and provided with a small loop of wire by means of which the crane hook may be attached.

The Meccano Theodolite Protractor consists of a sheet of superfine ivory card on which are printed circular and semi-circular scales, marked out in degrees. These two scales are for use in the Meccano Theodolite (Model No. 6.4), the former for indicating the extent of rotation of the model in a horizontal plane and the latter for indicating the angle of the sighting arm. These scales are also very useful in a number of other models. For example, the semi-circular scale is incorporated in the apparatus shown in Fig. 1, where its markings are used to register the movement of the beam under stress, while in Fig. 2 the circular scale acts as a measure of the extent of vertical rise or fall of a lift.

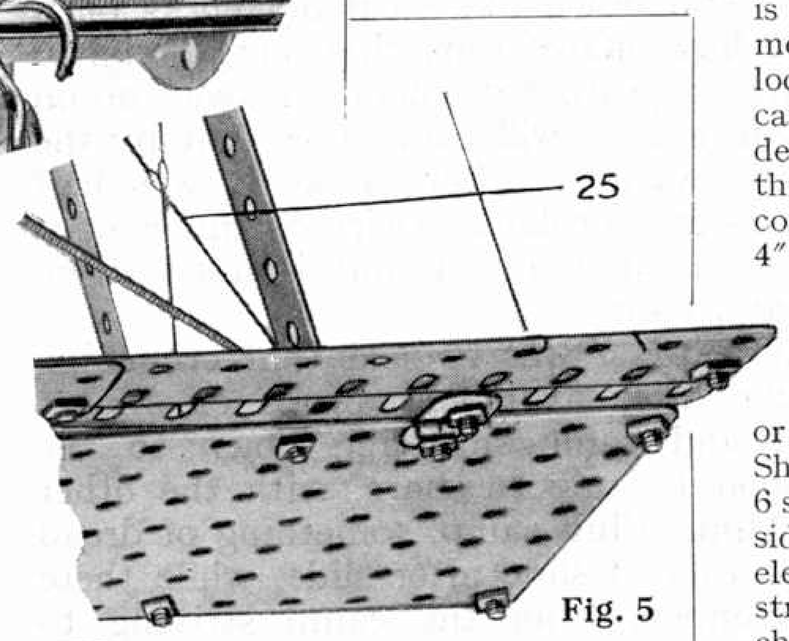


Fig. 5

The Collecting Shoe is intended for use in models of electric locomotives, tramway cars, and other vehicles designed to run on the three-rails system. It consists of a fibre strip 4″ long on which is mounted the metal contact pieces that press upon the centre or "live" rail. The Shoe is shown in Fig. 6 secured to the underside of a model electric loco, the fibre strip being held to the chassis by two $\frac{3}{4}''$ Bolts, on which are mounted Threaded Bosses 9 for spacing purposes. An insulated wire is led from one of the Motor terminals through the loco undercarriage and is secured by the Bolt 13, which also helps to secure the metal part of the Shoe to the fibre strip. The contact pieces, which are rounded and curved so that they slide easily along the rail, are each provided with a small spring to ensure proper contact. The current is picked up from the centre rail by the Shoe and is directed to the Motor by the wire attached to the Bolt 13. It returns to the accumulator by way of the framework of the model, the running wheels 7, and the outer rails.

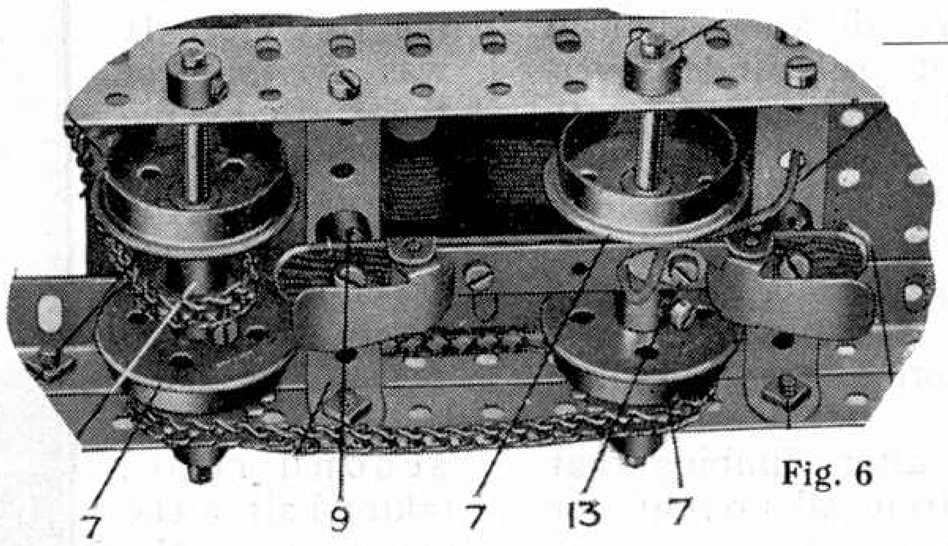


Fig. 6

The Pointer measures $2\frac{1}{2}''$ overall, and is provided with a boss that is set slightly off centre so that if the part is mounted loosely on an axle the Pointer will tend always to remain in a vertical position, with the point uppermost. It can be employed with advantage in all indicating devices; two examples are provided in Figs. 1 and 2. It is also employed in the radius indicator applied to the Meccano Derrick (see Instruction Leaflet No. 6).

The Meccano Fan may be used as a radiator cooling fan in model motor cars, etc. It also adds realism to model workshops.

It's all Right if Yo

Mountaineering a Splendid Physical Sport but Not for Weak

By Alan N.

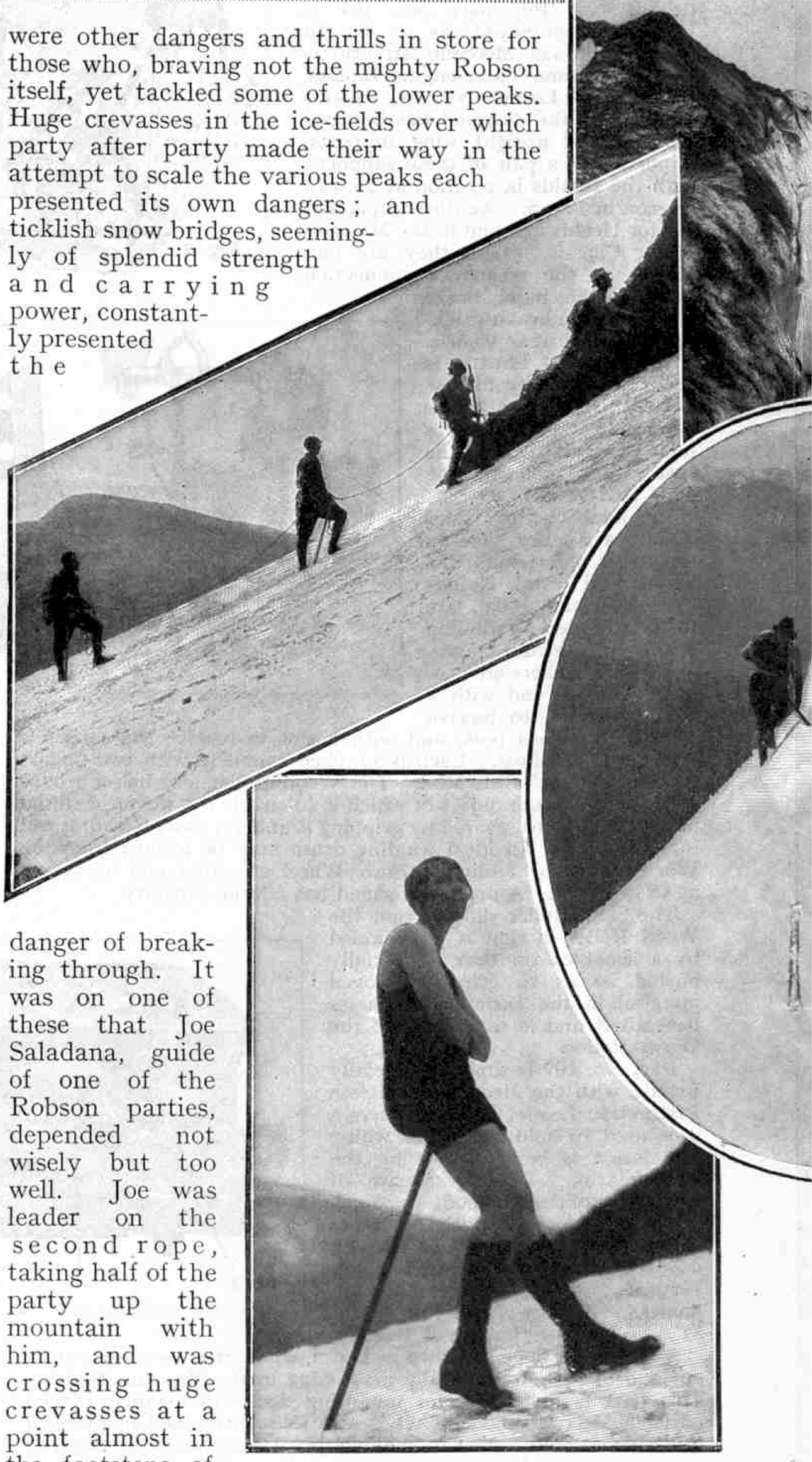
THERE was a prolonged sound as of distant thunder, coming nearer, as Bill and I halted on the Robson trail on our way in from Mount Robson station, in British Columbia, to where the Alpine Club were camped at Berg Lake on the summit of the Robson Pass.

"There she is," said Bill, pointing to a spot half way up the side of the Tumbling Glacier, which sprawls down the side of the highest peak in the Canadian Rockies. I looked for a storm cloud, for though the skies were absolutely devoid of clouds I had been informed that storms gathered very quickly on and about the peak of Mount Robson. Then I saw that what Bill meant was a bluish wisp of something that looked like smoke, trailing down the edge of the mountain. "That's *some* avalanche," said Bill, as the wisp of blue travelled down and the roar grew louder. Presently it terminated in a splash at the foot of the Tumbling Glacier, and Berg Lake developed waves a couple of feet high, while the ice-bergs floating about on its surface bobbed up and down like so many corks on a stormy sea. Just how many tons that berg weighed when it first worked loose from its moorings away up on the peak of Robson nobody will ever know, but by the time it reached the waters of Berg Lake it was half the size of a house—and probably twice as much of it had been worn off as it bumped and jumped down that slope of ice and rock.

Many times afterwards I was to hear that crunching sound as avalanche after avalanche broke off higher up the mountain and came slithering down to the valleys below. Soon I came to share, with the other occupants of the Alpine Club camp, something of dread as that sullen roar told of slide after slide, while there were parties of climbers from the camp striving to make the ascent of the peak. We all knew that at points on their journey they must pass under overhanging ice cliffs, where it seemed that even a breath was sufficient to dislodge tons of ice, and the climbers who happened to be in the way of one of those slides were within one breath of oblivion.

"It's no game for a man who gets cold feet," said Bill, as we sat beside the camp fire that night, and the longer I stayed in that camp the more I came to realize the truth of his statement.

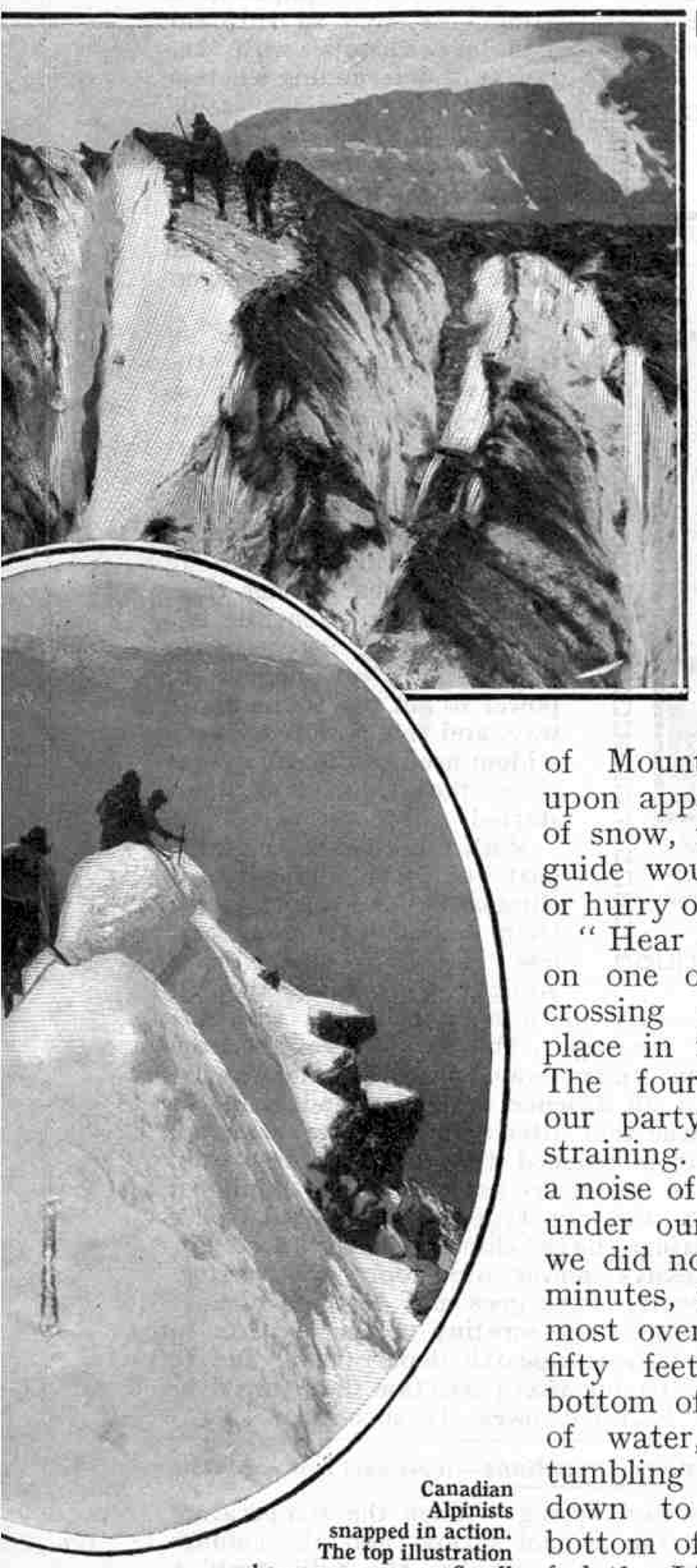
The return of a party to camp after climbing that mountain brought a sigh of relief from all present, for though there had not been a single accident to mar the success of the camp, Robson is a fickle jade at best. Her higher slopes are often wreathed in clouds and fog, and subject to the rising of sudden storms that might maroon the climbers far from their camp and friends, until the lifting of the fog or storm brought a chance to regain the solid footing lower down. Party after party had succeeded in the ascent, but always when a party was out on the mountain the sullen roar of avalanche after avalanche reminded those in camp of the constant dangers which must be faced. There were other dangers and thrills in store for those who, braving not the mighty Robson itself, yet tackled some of the lower peaks. Huge crevasses in the ice-fields over which party after party made their way in the attempt to scale the various peaks each presented its own dangers; and ticklish snow bridges, seemingly of splendid strength and carrying power, constantly presented the danger of breaking through. It was on one of these that Joe Saladana, guide of one of the Robson parties, depended not wisely but too well. Joe was leader on the second rope, taking half of the party up the mountain with him, and was crossing huge crevasses at a point almost in the footsteps of the preceding rope when, without warning, the snow bridge collapsed. The party were roped together, with those behind braced in expectation of anything happening, so Joe's fall was only for about ten feet. But his



ou Don't Weaken!

eaklings, or Those With Nerves That are Frayed or Jumpy!

N. Longstaff



Canadian Alpinists snapped in action. The top illustration shows a crevasse on Cavell Glacier. Mount Edith Cavell in the Jasper National Park is 11,033 ft. in height.

On the left are four climbers on the Bastion Glacier in the Tonquin Valley. In the oval, immediately above, the climbers are seen near the top of Mount Robson, the monarch of the Rockies. (13,700 ft.)

Below, and on the left, is a fair mountaineer posing for her picture on the Bastion Glacier

ice axe, which was not roped, went sliding down into that crevasse for another forty feet and delayed the party for over an hour, while they rescued first the guide and then his axe from its resting place fifty feet below the surface of the glacier. Time after time, in crossing the main glacier of Robson, the Coleman Glacier, or that on the upper slopes of Mount Mumm, we came upon apparently safe stretches of snow, when all at once our guide would either call a halt or hurry on ahead for a few feet.

"Hear that?" he asked us on one occasion, as we were crossing an apparently safe place in the Coleman Glacier. The four persons comprising our party stopped, with ears straining. What we heard was a noise of rushing water almost under our very feet. Though we did not know it for several minutes, we were standing almost over a crevasse, probably fifty feet in depth, at the bottom of which was a stream of water, several feet deep, tumbling and roaring its way down to the outlet at the bottom of the glacier, where it fed the Little Forks River that flows from there out to join the Mackenzie and thence into the Arctic Ocean.

Without a guide we should probably have stumbled on to one of those snow bridges, unless there is a special providence that keeps a special guard over would-be mountain climbers who go stumbling along over unknown rock and snowfields without having a guide along.

I had another sample of the vagaries of mountain territory a few days after reaching camp, when, hiking over the main Robson Glacier with a couple of well known climbers, we stopped to try a little climb on the rocky cliff-like sides of Mount Rearguard which, as its name implies, stands guard at the foot of the monarch of all the peaks of the Canadian Rockies. Two of the party climbed a few hundred feet up a rock chimney, roped together and proceeding foot by foot around corners where it seemed sometimes as though even a Rocky Mountain goat would have considerable difficulty in maintaining a footing. After they came down to the ice footing again, we lingered to make a number of photographs of the party on the glacier.

"Captain Mac," who was without doubt the most experienced climber in the party, was somewhat fidgetty during the whole of the performance. "Come on," he growled finally, and we moved. The captain heaved an audible sigh of relief when we had got out from under those beetling cliffs.

"Didn't you see all those marks of rock slides down the side of that cliff?" he asked me, finally. I hadn't seen anything but a few white scratches down the side of the mountain. "That's a healthy place to keep away from, son," he told me, "for those marks tell me that there have been very recent slides down that mountain just at the point where Lamb and I were climbing, and if you don't mind we'll make our pictures somewhere else."

Had there been anything more needed to convince me that mountain climbing is not altogether an indoor parlour game, to be played by those who like neither dangers nor strenuous effort, I got it that same afternoon in a climb on Mount Mumm, a nice comfortable-looking sort of peak, 9,740 ft. in height, which stands right up behind the bungalow camp at Berg Lake. Three of the party from the camp had started the ascent of Mumm earlier in the day with a guide and had taken lunch with them, intending to climb it half way, rest for lunch, and then complete the ascent in the afternoon. And I, inexperienced but brave enough to have tackled even Robson with a good guide, decided that as Mumm looked more like a hike than a real mountain climb I would go up and meet them about half way down.

After spending the morning on the glacier for the purpose of taking photographs, I started after lunch from the cabins to meet the party coming down the side of Mumm. Up and up I went, without finding any trace of the party except the spot where they had rested for lunch. Half way up they were not in sight, and a bluff of loose rocks seemed the only thing between myself and the point of vantage from which I had expected to see my companions on the downward way.

"Up is the way," said I, and went.

As I climbed, loose rocks slid down behind me into the valley below. Puffing and blowing like an engine on a steep grade, I finally reached the top of that rock bluff to see the preceding party just climbing up the rock chimney to the peak, which looked half a mile away. There was no sign of their starting to

(Continued on page 874)

Famous Aero Engines—(*Continued from page 853*)

are fitted to each cylinder. The "Falcon" engine is equipped with two twelve-terminal high-tension magnetos fitted in a similar manner to those in the "Eagle."

A centrifugal water-circulating pump of ample capacity is fitted below the wheelcase, and driven from this through serrated couplings arranged to take care of movement due to expansion or want of alignment.

Lubrication is arranged on the "dry sump" system, the bulk of the oil being carried in a service tank separated from the engine. The "scavenger" and "pressure" pumps are arranged as a unit, being bolted to the underside of the engine timing gear case and driven from the timing gear. The scavenger pump, which is of slightly greater capacity than the pressure pump, draws oil through the filter at the bottom of the engine sump and delivers it to the service tank. The pressure pump draws the oil from the service tank through a filter and delivers it to the main bearings and other parts under suitable pressure.

All engines are tested in accordance with the schedule of standard production and type tests as laid down for aero engines by the Air Ministry. In addition all mild and alloy steels used in the construction of the engines are carefully tested in the raw state, the bars and billets being proved by heat-treatment, fracture and Brinell test, in order to ensure that the raw material is correct to specification, while each individual crankshaft and propeller shaft forging is tested separately.

New White Star Liner—(*Cont. from page 837*)

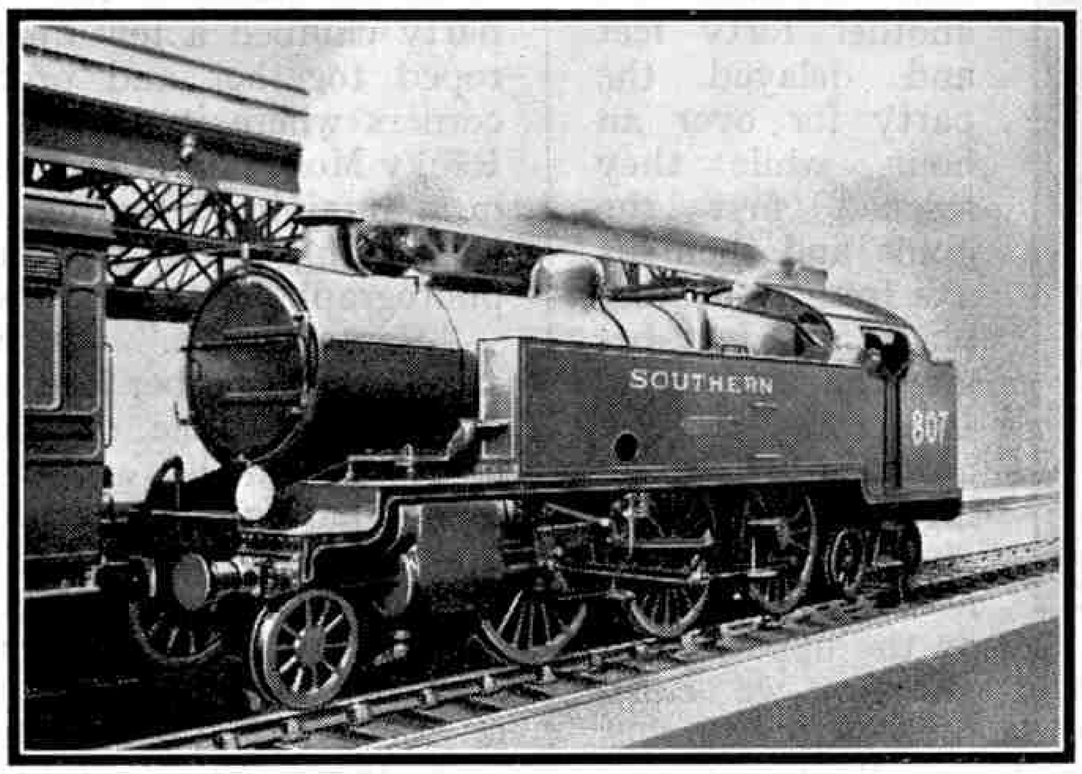
for 10,000 b.h.p. The cylinders are arranged for fresh-water cooling, and oil-cooled pistons are employed. There are four independent injection air compressors, each of which is driven by a four-cylinder trunk type engine.

Four generators have been arranged to supply the necessary electric power for engine-room and ship's purposes, and are driven by six-cylinder trunk motors of the same general type as those employed for the air compressors. Four main engine exhaust gas fired boilers will generate steam at sea. Each boiler has a designed heating surface of 500 sq. ft. and is 5 ft. 6 in. in diameter and 10 ft. in length. They are designed to generate from 2,500 lb. to 4,000 lb. of steam per hour, according to the load, at a working pressure of 100 lb. per sq. inch.

In port, one exhaust gas boiler of the same type, 4 ft. in diameter and 10 ft. in length, will be available for use in connection with the auxiliary generator engines. This has a designed output of 1,800 lb. of steam at 100 lb. pressure. There are also two oil fired cylindrical single-ended boilers for generating steam in port and at sea for heating and cooking purposes.

It is expected that the "*Britannic*" will be placed in service next year.

Before Being Re-conditioned



Photo] [*K. Bindoff*

A member of the former Southern Railway "River" class 2-6-4 Tank Locomotives, No. A807, "River Axe." This and the remainder of the class have since been rebuilt and are running as 2-6-0 tender locomotives

It's all Right if you Don't Weaken—(*Continued from page 873*)

come down, so I started across the glacier to join them.

"Keep to the left," yelled the guide, and not knowing why, I edged off to *my* left in accordance with instructions. "To the *left*, to the *left*," yelled the guide, and suddenly it dawned upon me that I was facing in the opposite direction to him and therefore his left was my right hand. I got into reverse so quickly that I almost went into a tail spin, and finding the tracks of the party followed them to the base of the rock chimney from which the actual peak was to be gained.

The party were coming down from the peak to the glacier, I knew by the sound of falling rocks that slid half way down the ice slopes. Then suddenly I heard voices, and looking round saw the party at the top of the glacier. Preparing to climb the rest of the way and join them, I had just got to my feet when I heard screams and saw a cloud of snow and what was evidently the four members of the party sliding down the snow slope at express train speed. I thought at first it was part of the game, in spite of the screams of the ladies in the party, until I looked down below and saw a crevasse, fully 30 ft. in width and possibly 100 ft. in depth, yawning for them about 20 ft. away.

"What's the matter?" I asked innocently.

"Well, I ought to have known better than to let her make even this climb without proper nails in her shoes," said the guide, referring to the lady who had been leading on the rope. The rest of the story was that she had lost her footing and started to slide before everybody had got properly on their feet at the top of the glacier.

But after all, the result is worth the effort and the spice of danger only adds to the enjoyment. I hope to go back again, for there are two or three peaks around that Mount Robson district that I want to see at close quarters, after which perhaps I'll feel big enough and strong enough to tackle some real climbing.

Pennsylvania Railroad Abolishes Wooden Passenger Coaches—(*Continued from page 839*)

passengers breathe warmed fresh air. In summer, of course, the heat coils are out of action. Stale air is passed out of the coach through ventilators situated above the electric light fixtures. This system of ventilation distributes a continuous flow of fresh air through the coach under every condition of weather.

The latest innovation in Pennsylvania Railroad passenger coach equipment is the roller bearing. As early as 1915 the company began experiments with the object of determining whether anti-friction bearings could be used in passenger coach trucks. As a result, several hundred of their coaches are now equipped with roller bearings, and they have been made standard for passenger-carrying equipment.

The great advantage of roller bearings lies in the ease with which trains so equipped can be started from a standing position. To start a train equipped with the old bearings an appreciable excess of power is required over that which will easily handle an even heavier train once it is in motion. It has therefore been necessary to provide a great reserve of power to get the trains under way, and this power was very seldom used to the full extent once the train had been started.

With roller bearings a large part of this difficulty is eliminated. The roller bearing train requires 80 per cent. less power to start on a straight level track than is necessary for a train equipped with the old bearings. The locomotive gets the train under way smoothly and easily, with an absence of all jar and jerk. It is true that after a speed of two miles an hour is reached the roller bearing train is no easier to haul than one equipped with the old type bearing; but roller bearings have eliminated the need for excessive power used only for starting.

So the work goes on. Nothing escapes the unceasing scrutiny of the experts in the various research departments, and to this striving after perfection the Pennsylvania Railroad owes its success.

Famous Inventions—(*Continued from page 843*)

tiny steel spring. When the temperature falls the alcohol shrinks and the column of mercury approaches the bulb, pushing up the index in front of it so that its lower end indicates the coldest or minimum temperature since the last setting. When the temperature rises the alcohol expands and pushes the mercury and index upward in the other branch, so that on this side the maximum temperature is registered. The indexes remain at the points to which they have been pushed, and for the re-setting they are brought down to the top of the mercury by shaking, or by means of a magnet.

For very valuable assistance in the preparation of this article we are indebted to the courtesy of the Technical Department of A. Gallenkamp & Co. Ltd., Scientific Instrument Manufacturers, London.—EDITOR.

The Somerset Willow Industry

By K. Norman Browne

MOST of us connect the Isle of Athelney with King Alfred and his cakes, and we can well imagine faithful Americans alighting at Athelney station to plod up the hill, on the summit of which stands a monument popularly—but I believe wrongly—supposed to mark the scene of the great King's transgression. It is our purpose here to oust King Alfred from his pinnacle of local importance, and to place in his stead the willow industry.

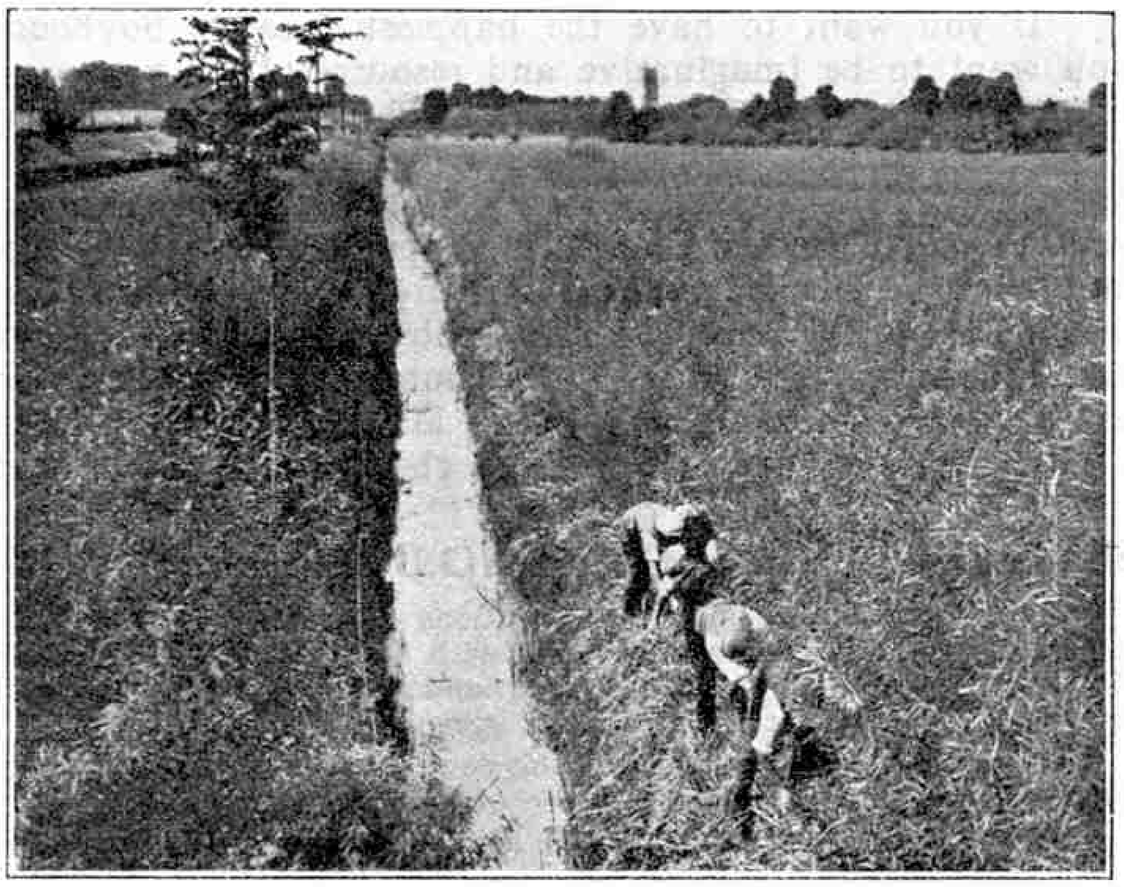
The industry is no new one. For generations, the low, marshy, Somerset fields, cut by their dykes, have in due season been softly green with withes. Here and there the tower of some old church, nestling in its quiet village, reminds us that this is still England, otherwise the scene suggests the Netherlands. Every villager in the district has his finger in this industrial pie. All along the roads are the "brakes"—iron instruments where, in the rush season, the women sit peeling and stripping.

Photos by ["The Times"

The rods being peeled, trimmed, and tied into bundles, after they have stood in the sun to whiten

The work on the fields of the big growers occupies the whole year. Cutting begins about November, and continues, when floods permit it, through the winter. Those withes that are to be sold as buff-coloured are boiled for six hours in an open air boiler, while those which are to become white are retained for "whitening," a process requiring that they be kept throughout the winter, while often during this time they sprout and grow a little. In May, these are peeled and made into bundles. This is the busiest season of the industry, and every man and woman in the villages of the district is worked early and late.

Withes are mentioned in the Bible—possibly the implements used in their production have changed little since then. This is probably of all English industries the least affected by the passing of the centuries. Each withe has to be cut individually in the traditional way, and each peeled by the antique method of rubbing against iron. Afterwards, they have again to be sorted into bundles of varying lengths. New machines have been tried from time to time for peeling, but never found to be adequate. It seems almost impossible to believe that from those acres of withes every single one has to receive individual treatment at the hands of a labourer.



Labourers at work in the osier willow beds near Taunton, the centre of the Somerset Willow Industry

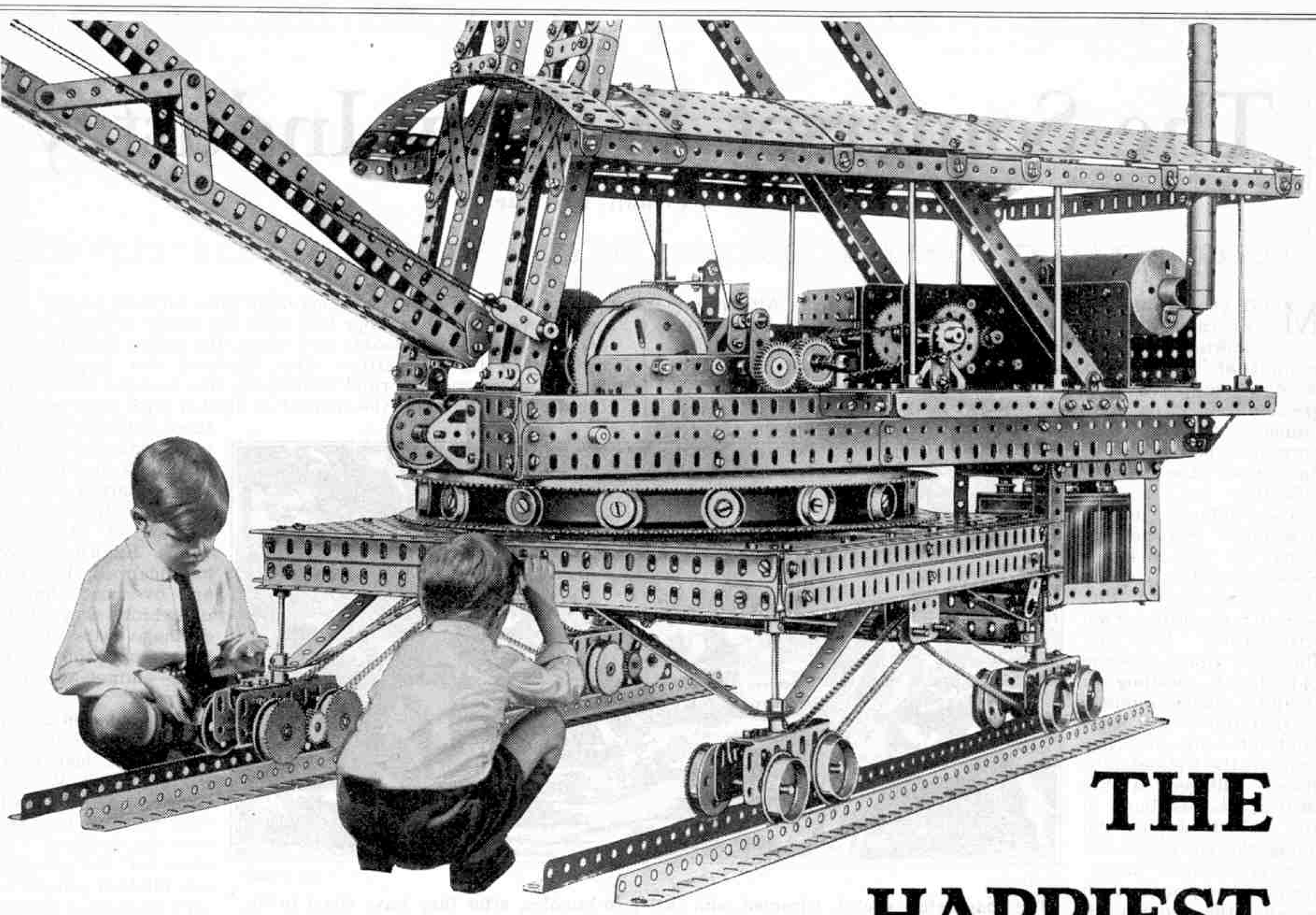
It can soon be realised that with the amount of work involved, the cost of production must inevitably be high, but still it is sad to find that such an old industry has fallen on bad days. During the war, withes were found to be admirable material for shell cases, and their value mounted accordingly. Growers received an average payment of £1 a "bolt" or bundle. The price of land increased in proportion, small growers paying large sums for their plots. There seemed every reason to hope that with the return of peace, and the renewed demand for baskets and chairs, the willow industry would continue in its prosperity. Alas, however, for bright hopes! The return to more normal conditions also brought back foreign competition. To-day, the market is flooded with both manufactured articles and the raw material, sent in such bulk that the transport charges are appreciably lessened, and marked at prices with which English growers, handicapped by wages and overhead charges—in which they include drainage rates, in many cases amounting to £1 an acre—cannot attempt to compete.

The situation has now become so serious that within the last year a Somerset Willow Growers' Association has been formed to wrestle with the problem. Trial plots for the growth of new kinds of willows have been planted at Stoke St. Gregory and Drayton, and the utility of some thirty different kinds is now being tested. The new Association suggests that further plots should be established. Other suggestions include the more careful grading of the rods, experiments in new designs for basket-making—those of our foreign competitors (principally Germany and the Netherlands) admittedly making up in attractiveness for what they lack in execution—and the adoption of further measures for the lessening of the insect pests. At present, blight is one of the worst of these, as whole fields may be damaged irretrievably before the spraying apparatus can be brought into play. Last but not least, the vexed question of the advisability of a tariff on foreign willow imports is under discussion.

The growers send their produce to markets far and wide, while at Bridgwater and North Petherton, a few miles from the Athelney district, there is a wicker furniture industry that employs several thousand workers. Most of the transport is done by rail. Rates for willows were lowered from May last, and it is now stated that, estimating the export of willows from the county at about 2,500 tons annually, the saving in railway rates to those concerned amounts to over £1,000 a year:—drops in an ocean, perhaps, but of the right consistency.

Every summer the withes emerge, slender and green, as if they had scorned the wintry elements. Perhaps this is prophetic of what is coming to the industry, and this "winter of our discontent" may yet bring forth a prosperous summer.

(For this article we are indebted to the Great Western Railway Magazine.—EDITOR).



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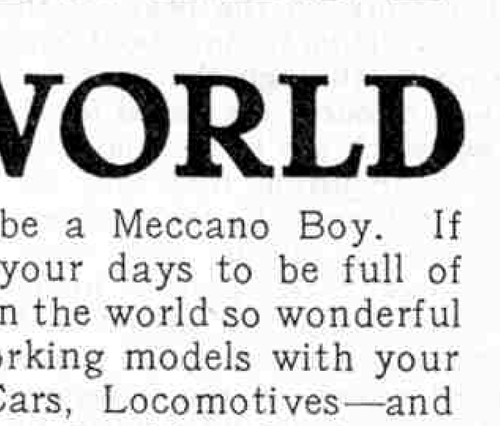
Write clearly and put No. 70 after your name for reference.



MECCANO

MECCANO LIMITED OLD SWAN LIVERPOOL

Special Winter
Model-Building Competition

A Great Opportunity for Boys of All Ages

THIS month we have pleasure in announcing another entirely new Model-building Contest. In this, as in the previous contests, full rein is given to our readers' inventive abilities, and there are no rigid stipulations as to the type of model that may be submitted or the size of Outfit or number of parts that may be used. It must be borne in mind, however, that it is not necessarily the largest models that will carry off the prizes. There are no entrance forms or fees. The many splendid prizes offered are shown in the accompanying list.

As in all previous model-building contests the most telling point will be originality—either with regard to the type of apparatus chosen as the subject of the model or to the novel uses to which Meccano parts employed in its construction are put.

Entries received from readers residing in the British Isles will be divided into two Sections, Section A for readers over 14 years of age and Section B for readers under 14 years of age. The object of this arrangement is to ensure that every competitor has an equal chance and is called upon to compete only with other readers of approximately the same age as himself or herself. All entries from readers Overseas will be grouped into Section C. It is not thought necessary to further divide the Overseas entries, but the age of each competitor will be taken into consideration when making the awards.

THE PRIZES

The Prizes to be awarded in Sections A and C are as follows:—

First Prize: Meccano goods to value three guineas.
Second Prize: Meccano goods to value two guineas.
Third Prize: Meccano goods to value one guinea.
Six Prizes, each consisting of a Meccano Presentation Leather Pocket Wallet.
Twelve Prizes, each consisting of Meccano goods to value 5/–.
Twelve Prizes, each consisting of a "Meccano Engineer's Pocket Book."

The Prizes in Section B are as follows:—

First Prize: Meccano goods to value two guineas.
Second Prize: Meccano goods to value one guinea.
Third Prize: Meccano goods to value 10/6.
Six Prizes, each consisting of Meccano goods to value 5/–.
Twelve Prizes, each consisting of a Complete Instructions Manual.
Six Prizes, each consisting of a "Meccano Engineers' Pocket Book."

A limited number of Certificates of Merit will be awarded in each Section.

The First Prize in each section will be awarded to the competitor who builds the model that the judges consider to be the most original and best constructed in that section. The Second and Third Prizes will go to the second and third best models, and so on.

It is not necessary to send actual models. A clear photograph, or if this is not possible, a good drawing is all that is required. If the model possesses unusual features not easily apparent from the photo or drawing, a brief explanation may be desirable, and this should be written on a separate sheet of paper and sent along with the photo. Any model entered must be the competitor's own work, both in design and construction, but photos or drawings need not be his own handiwork.

The following instructions must be followed closely:—The competitor's age, name, and address must appear on the back of each photograph or sheet of paper used, together with the letter (A, B, or C) indicating the section in which the model is entered, and the name of the competition ("Winter" Model-building Competition). Envelopes are to be addressed "Winter". Model-building Competition, Meccano Ltd., Binns Road, Old Swan, Liverpool.

Entries for Sections A and B must reach this office not later than 31st December, 1929. Closing date for Section C: 28th February, 1930.

A MECCANO "MECHANISM" COMPETITION

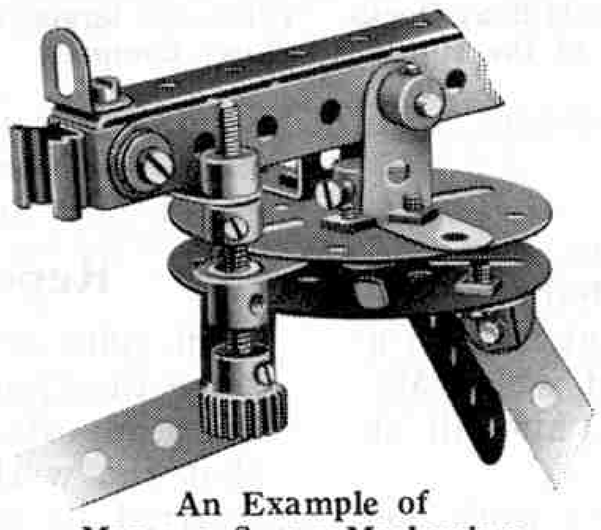
This unusual type of model-building competition should appeal to all boys who like to satisfy their inventive abilities by designing mechanical movements from their own ideas. Readers of all ages may compete and no entrance fees or forms are required.

Most Meccano boys doubtless are aware that the terms "mechanism" and "machine" are often used indiscriminately. What is usually meant by "machine," however, is a mechanical contrivance considered as a whole, whilst by "mechanism" we refer to the internal details of a machine. Thus a machine may consist of an assembly of "mechanisms."

One of the earliest known mechanisms is the screw—which is really a modification of the inclined plane. Its use in various forms in the construction of modern machinery is practically limitless and it is therefore of special interest to Meccano model-builders.

A typical example of a machine employing the screw as its principal feature and driving element is to be found in the ordinary screw-jack, which is used for lifting heavy bodies, as, for instance, when it is necessary to raise a motor car in order to remove a wheel.

Screw gear already plays an important part in a number of Meccano models, but there must be many new and interesting mechanisms that can be built with its aid. In this competition therefore we shall award a number of splendid prizes for the most ingenious models of Meccano screw mechanism. All entries must feature some form of screw gear. It is not necessary to build a complete model. All that is required is just a section of a model embodying some movement or effect gained with the aid of screw gear.



An Example of Meccano Screw Mechanism

As an example, we illustrate herewith a section of a model machine gun in which a Threaded Rod is used as a means of adjusting the elevation of the gun. This, together with several other adaptations of the screw principle, is described fully in the Meccano Standard Mechanisms Manual. Intending competitors should remember, however, that any mechanism that has already appeared in any of the Meccano Manuals, etc., is not eligible for this contest. Each entry must be the competitor's own handiwork both in design and construction.

Actual models must not be sent. It is only necessary to submit either a clear photo or a good drawing together with a short description of the mechanism. The competitor's age, name and address are to be written on the back of all photos or drawings sent. Entries will be divided into two Sections—Section A for readers of all ages residing in the British Isles and Section B for readers residing Overseas. Envelopes containing entries are to be addressed to "Mechanisms Contest" Meccano Ltd., Binns Road, Old Swan, Liverpool. Closing dates: Section A, 30th November. Section B, 28th February, 1930.

Prizes will be awarded in each Section as follows: First, Meccano goods to value £1-1s.; Second, Meccano goods to value 15/–; Third, Meccano goods to value 10/6. Twelve prizes, each consisting of a Meccano Engineers' Pocket Book. The prizes will be won by entries displaying the most novel form of screw mechanism.

The Year's Progress

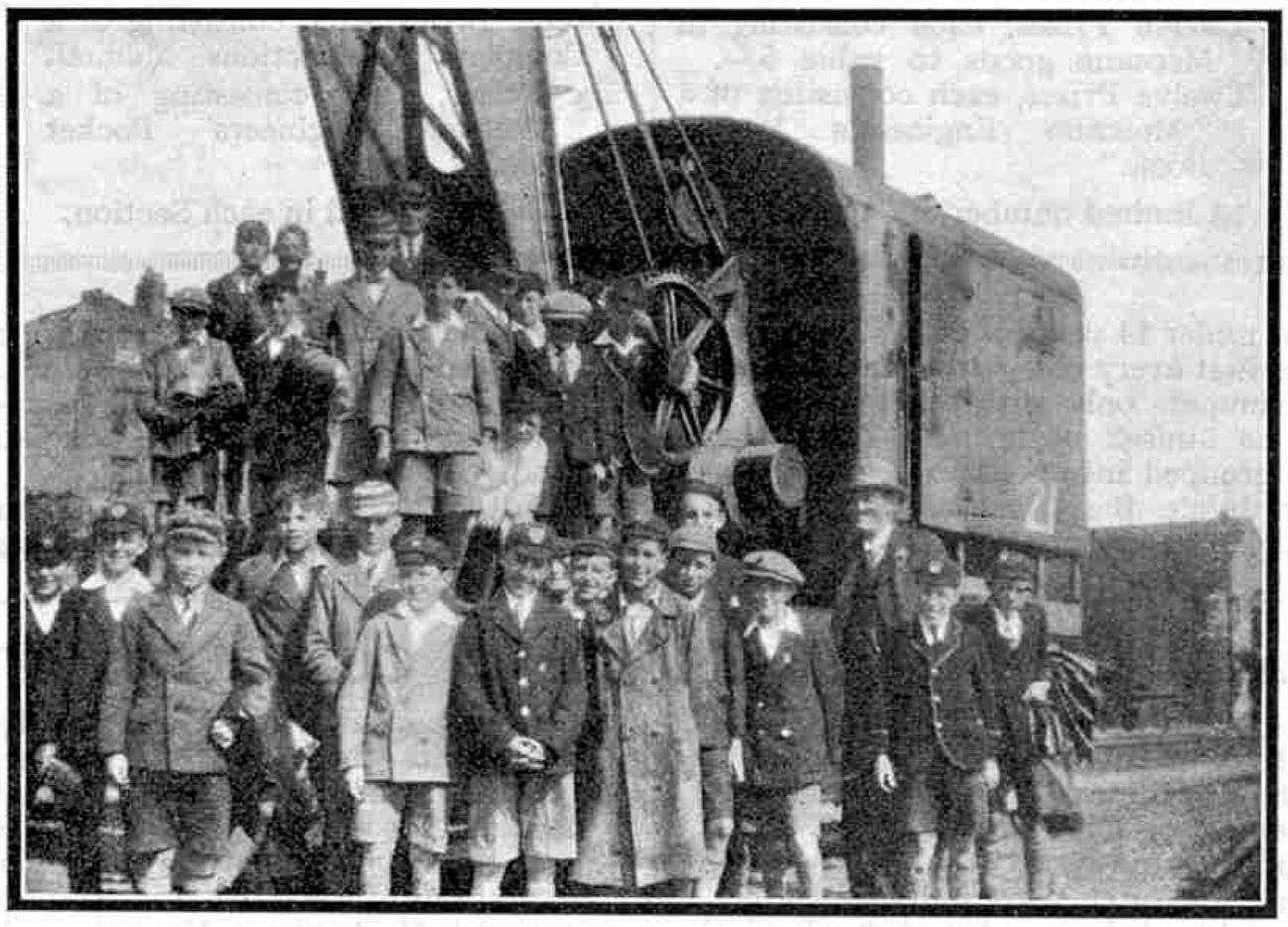
The Hornby Railway Company now enters upon the second year of its existence, and it will be of interest to review the progress that has been made.

When the formation of the H.R.C. was announced in October of last year, the scheme was greeted with immediate enthusiasm, and the welcome it received confirmed me in my belief that the organisation would fill a big gap that existed in the model railway world. Within a few days letters began to pour in from owners of Hornby Trains and others interested in model railways, and the general effect of these letters was that the H.R.C. was the very thing for which the writers had been waiting for years.

A remarkable feature of the enthusiasm that greeted the scheme was the immediate interest taken in it by railway officials of all grades. This interest has increased steadily during the year. It is evident that these officials realise that the next generation of railwaymen will be recruited largely from the ranks of the H.R.C., and they have done their utmost to assist the Company in general, as well as the individual members with whom they come in personal contact.

The present position is very gratifying. In twelve months the membership of the H.R.C. has grown to over 10,500, and this membership is distributed throughout the whole Empire. Such an achievement in such a short period is very remarkable, and one of which Mr. Frank Hornby, President of the Company, and all at Headquarters, are very proud.

An equally gratifying feature of the year's work has been the success of the scheme for the formation of local Branches of the Company. At the present moment no less than 80 of these Branches are officially incorporated with the parent Company, and are in a flourishing condition. New Branches are being formed everywhere, both Home and Overseas, and it is clear that this section of the H.R.C. scheme is assured of a splendid future.



A group of members of the Plymouth (St. Bartholomew's) Branch, No. 37, taken during a visit to Millbay Docks. This is the largest incorporated Branch of the Hornby Railway Company

The New "*Hornby Book of Trains*"

I wish to draw the attention of H.R.C. members to the new issue of the "*Hornby Book of Trains.*" This contains a wealth of information on railway matters and will be found extremely helpful to Branches and individual members alike. A particularly interesting article in the book describes a trip on the footplate of a locomotive. From the preparation of the locomotive to its arrival at its destination, every detail is in accordance with correct railway practice, and from it many interesting hints may be gathered regarding a railway journey from the driver's point of view. Another article describes in detail how the permanent way is kept in repair so that safe and smooth running is always ensured. Other articles describe the work of the mail trains that tear across the country during the night, and give a fascinating account of four of the most famous British expresses.

Last, but not least, the book contains full details and splendid coloured illustrations of the new Hornby Locomotives, Rolling Stock and Accessories.

The book may be obtained from any Meccano dealer, price 3d., or it may be ordered direct from Meccano Limited, Binns Road, Old Swan, Liverpool, price 4½d. post free.

Reports from Branch Secretaries

In spite of many urgent requests, the secretaries of some incorporated Branches either send in very inadequate reports, or omit to send any at all. The result is that the work of these particular Branches cannot be referred to on the "Branch Notes" page. This is a very unfortunate state of affairs, and I hope that all Branch Chairmen will do their utmost to see that their secretaries send in regular reports containing as much detail as possible. If a few brief notes are jotted down at the conclusion of every meeting it is a very easy matter to prepare, month by month, an interesting report of Branch activities.

Branch Notes

LENTON SANDS.—Three interesting meetings have been held by the members of the Junior Section, and cycle runs are still an important item on the Branch programme. The second issue of the Branch Magazine has been produced and has turned out very successfully. Up to the present all track meetings have been held in the open but a Branch room is urgently needed for the winter season. Any reader who can suggest a suitable room in the neighbourhood is asked to communicate with F. W. Byron, of 125, Harrington Drive, Lenton Sands, Nottingham.

IPSWICH.—A very successful Exhibition has been held by which the Branch funds have benefited greatly. Visits to the local railway station are very popular and each member is provided with a notebook in which he jots down all items of interest. These interesting points are then made the subject of general discussion at the next meeting. A caretaker has been appointed to look after the Branch room and to see that everything is kept in good condition. It is hoped to take up the old track shortly and replace it with a better one, and in this connection a competition is being held for the best plan of a layout.

SOLIHULL.—A Demonstration of model railway operating was held during the month and parents of members were invited to watch the proceedings. The function was successfully carried through and strict timetable working was adhered to. Operations lasted three-quarters-of-an-hour and were greatly appreciated by the audience. Photographs were taken and afterwards the visitors were entertained to tea. An "Astronomy Night" is to be held during the month, and the members will have the privilege of seeing the moon and the stars through a large telescope owned by the Chairman.

STROUD GREEN.—A very interesting visit has been paid to the Hornsey Loco Sheds. The members were conducted round by the Foreman of the Sheds and were allowed to examine closely a number of the engines. They next inspected the old battered "4585" which had been badly damaged by a fall into the small turntable. Special interest was shown in the coaling stage. A visit has also been paid to the King's Cross Sheds, where members were allowed on the footplates of six engines.

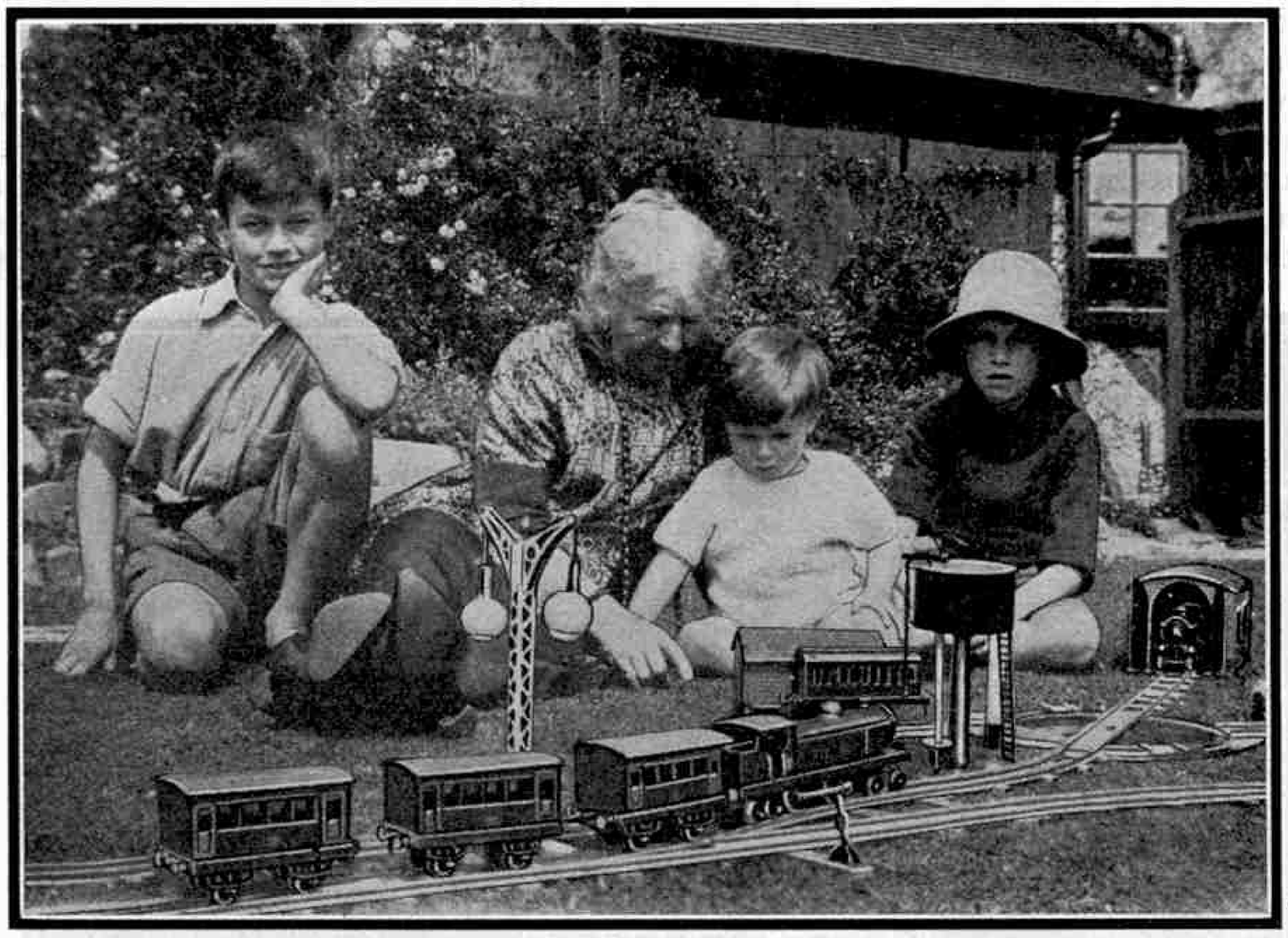
WEST HARTLEPOOL PROGRESSIVE.—A very busy period has been spent in erecting the Branch railway. A shelf 2 ft. 8 in. in width has been erected 3 ft. from the ground and it extends entirely round the room. On this members have screwed down a double track. A main station has been built large enough to accommodate easily a train of three Pullmans.

MONTPELIER.—Track meetings have been held regularly during the month and frequent visits have been made to places of railway interest in the neighbourhood. New members have brought with them a fair amount of accessories, which add greatly to the realism of the layout. It has been decided to paint scenery to go round the walls of the club room.

NOTTINGHAM.—A very busy month has been spent in moving the rolling stock into the new club room ready for the winter. Branch funds have increased so satisfactorily that it is hoped to add a Metropolitan locomotive to the system shortly.

FARNHAM GRAMMAR SCHOOL.—A recruiting campaign has been started and has already resulted in the enrolment of five new members. Two successful meetings were held during the month, the first being a business and track meeting. The second meeting had a record attendance and speed trials were arranged, 16 engines of various types being entered. Some very good performances were witnessed and a table of results was compiled. A visit to the Guildford Running Sheds has been arranged, and other trips of railway interest are contemplated. Competitions modelled on those that appear in the H.R.C. section of the *"M.M."* are to be held regularly.

NEATH.—Excellent progress has been made during the month. Extensive alterations and additions have been made to the layout, a goods yard having been erected and a double line tunnel. A bell has been installed in one of the yards which rings in the signal cabin, so that no talking is necessary and all trains are now running strictly to timetable. The track has been divided into two Divisions and two Divisional Engineers have been appointed. A subscription box for new stock has been established and, as suggested in the August *"M.M."* a Repair Fund has been started. It is proposed to paint the name of the Branch on the backs of the Company's locomotives.



The right age for Hornby Railways! Ian Buchanan (H.R.C. No. 577), his two brothers and his grandmother with their Hornby Railway in the garden

Further Branches in Course of Formation

The following new Branches of the Hornby Railway Company are at present in process of formation and any boys who are interested and desirous of linking up with this unique organisation should communicate with the promoters, whose names and addresses are given here. All owners of Hornby trains or accessories are eligible for membership and the various secretaries will be pleased to extend a warm welcome to all who send in their applications:—

ALUM ROCK—A. Ratcliffe, 124, Alderson Road, Alum Rock, Birmingham.

BIRMINGHAM—Eric A. Bates, 316, Dudley Road, Edgbaston, Birmingham.

BIRMINGHAM—Edward Walker, St. Mary's Vicarage, Aston Brook, Birmingham.

CARDIFF—A. V. Strong, 24, City Road, Cardiff.

COVENTRY—Geoffrey Bull, 131, Hearsall Lane, Coventry.

DERBY—Ernest L. Kopcke, 39, Kenilworth Avenue, Derby.

EDINBURGH—Francis Spaven, 34, Hillview Terrace, Corstophine, Edinburgh.

LONDON, S.E. 5—L. G. Butler, 46, Smith Street, Camberwell, London, S.E. 5.

OVERSEAS

AUSTRALIA—Mr. Alex. Cohn, 12, Banool Avenue, Kew, Victoria, Australia.

NEW ZEALAND—Albert Saunders, 17, Te Aroha Street, Hamilton, N.Z.

SOUTH AFRICA—W. Dunsdon, "Mabmardon," 39, Belvedere Avenue, Oranjezicht, Capetown, S.A.

Further H.R.C. Incorporated Branches

68. EVENLODE (MORETON-IN-MARSH)—G. Gorman, Evenlode Rectory, Moreton-in-Marsh, Gloucestershire.
69. THE HALL (SYDENHAM)—John D. Davies, 28, Kingsthorpe Road, Sydenham, London, S.E.26.
71. FIRST CAMBRIDGE—J. Manning, Emmanuel Ground, Adams Road, Cambridge.
73. FIRST ALVA—Wm. McArthur, 72, Queen Street, Alva, Clackmannanshire.
74. THE EARLSDON (COVENTRY)—R. Hawthorn, 61, Berkeley Road, Coventry.
75. THE OXTON (BIRKENHEAD)—J. H. McGuinness, 63, Beresford Road, Oxton, Birkenhead, Cheshire.

OVERSEAS

70. NAREMBURN (N.S.W.)—Ronald Pauling, 8, Glenmore Street, Naremburn, North Sydney, N.S.W., Australia.
72. DUNEDIN (NEW ZEALAND)—Tony MacLachlan, Art Studio, 66, Albany Street, Otago, New Zealand.

Hornby Railway Company

JUNIOR SECTION

XI.—Preparing for Winter Evenings

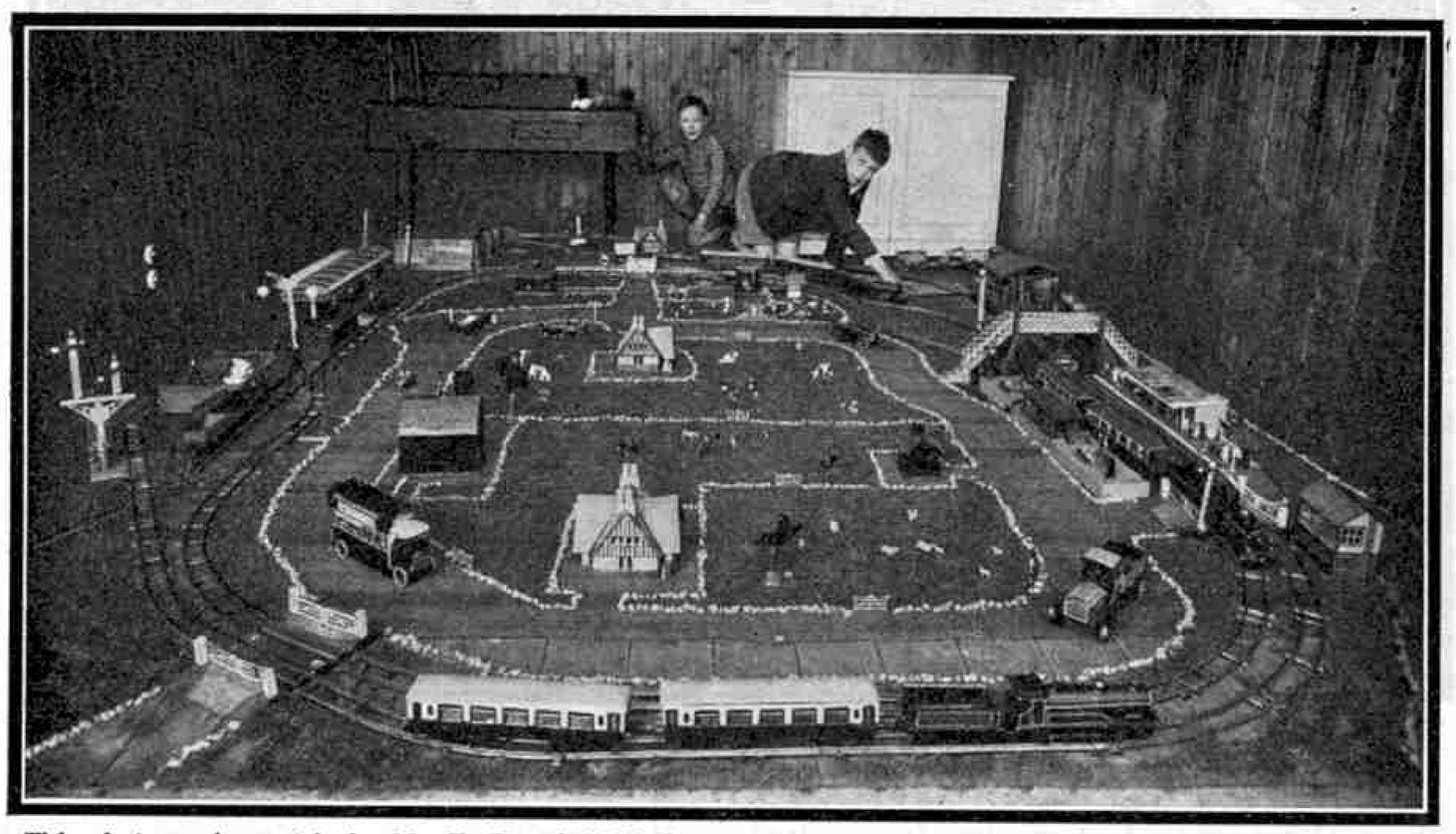
NOW that the dark evenings have arrived in earnest, Hornby Railway enthusiasts will be turning with renewed interest to their model railways, taking stock and making plans for improved layouts.

Before settling down to devise new layouts the existing material should be given a thorough overhaul. All the rails, points and crossings should be examined carefully to detect any defects such as loose sleepers, missing pegs, or sections of rail bent out of shape.

Examining the Track

Testing the rails for accuracy of gauge should be carried out by means of the back of the key that is used for winding up the clockwork motor. This part of the key has been specially made the exact width from inside to inside of the heads of the rails, and by sliding it round the track defective places are easily discovered. Still another point is to make sure that there is an ample supply of connecting plates for fixing the rail lengths firmly together.

If the rails, points or crossings have become dirty or rusty they should be thoroughly cleaned with a rag moistened with paraffin or petrol. If paraffin is used it should be given time to dry before the locomotives are run over the track, and neglect of this precaution will result in bad wheel-slip.



This photograph, sent in by Mr. T. Campbell Walker, Campbellfield, Irvine, Ayrshire, shows how the interest of a layout may be increased by the addition of a variety of accessories. In the excitement of arranging for the photograph the passenger expresses were "posed" on the wrong lines!

Locomotives and Rolling Stock

The rolling stock should be examined, piece by piece, the special point to observe being that all the wheels revolve quite freely. Bent axles should be gently straightened where necessary, and the couplings also should be examined to see that they work quite easily. Dust that has collected about the axles should be cleaned off with a paraffin rag.

The greatest care of all should, of course, be given to the locomotives. The mechanism of each one should be thoroughly cleaned with paraffin or petrol as a preliminary to oiling. The advantage of petrol as compared with paraffin for this purpose is that it evaporates quickly, so that oiling can be proceeded with almost at once. If paraffin is used, however, the various parts should be given time to dry before oiling is commenced. If this is not done the paraffin that remains causes trouble by diluting the lubricating oil. Whether paraffin or petrol be used as the cleansing agent, it is a good plan to keep it in a separate Meccano Oil Can, by means of which all parts of the mechanism can be reached conveniently. In this manner it is kept handy for use and yet cannot be spilled, which is a particularly important point in the case of petrol.

Advice on Lubrication

In regard to lubrication, it cannot be too strongly emphasised that only a very small quantity of oil is required. Some beginners seem to be under the impression that it is necessary to flood the whole engine with oil each time it is run. This is not only unnecessary and extravagant, but is very likely to involve the young railway enthusiast in trouble with the domestic authorities for making an oily mess on the carpet or elsewhere! All that is needed is just a spot of oil on each spindle and gear and a little between the plates of the spring. Excess of oil is actually harmful in collecting dust which, in time, clogs the mechanism very seriously.

When the outfit has been thoroughly overhauled further developments may be considered. In many cases, no doubt, holiday journeys will have suggested fresh ideas. Some particular method of working may have attracted notice, or some new or unusual building, bridge or tunnel will have suggested possibilities for reproduction in miniature.

Suggestion for Single-Line Working

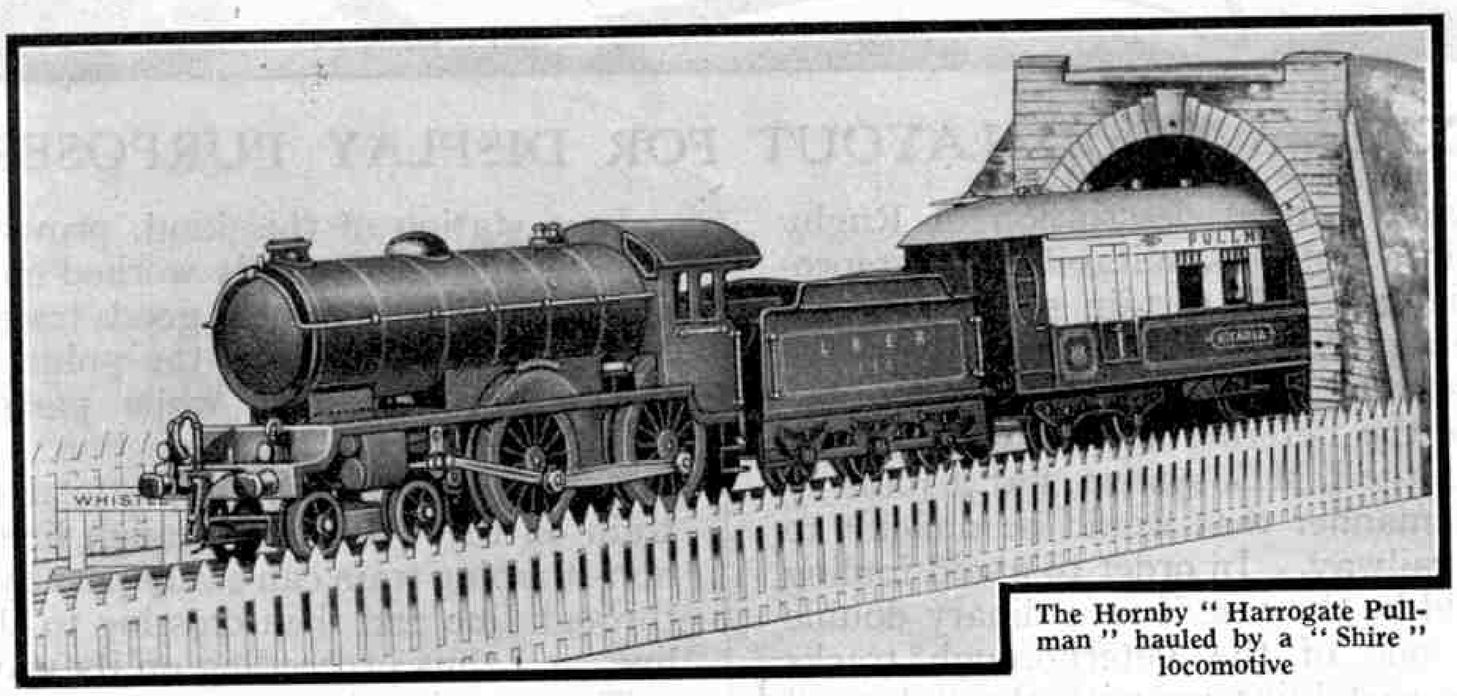
Perhaps a country branch line will have been noticed on which the passenger service was provided by an "auto-train" of the "push-and-pull" kind. These trains usually consist of perhaps two carriages and a small tank engine. When travelling in one direction the engine leads, while for the return journey it does not run round its train, but simply reverses and pushes the coaches from the rear. Arrangements are made to enable the engine to be controlled from the leading

coach. The driver rides in this when the train is run backward, while the fireman remains on the footplate.

A train of this kind can very easily be run on a model system with perfect success. For working a simple branch line this method is, indeed, ideal, for there is no real necessity for anything more than a single line, as the engine has no shunting movement to perform before commencing the return journey. Very frequently on small branch lines one or two goods wagons are also attached to the passenger train, and this "mixed-train" working may very well be imitated.

An Interesting Layout

The accompanying layout (Suggested Layouts No. 5) is one that can be thoroughly recommended for trial. It is quite simple in construction and requires a comparatively small amount of material, while at the same time keen railway enthusiasts will find it exceedingly interesting to operate.

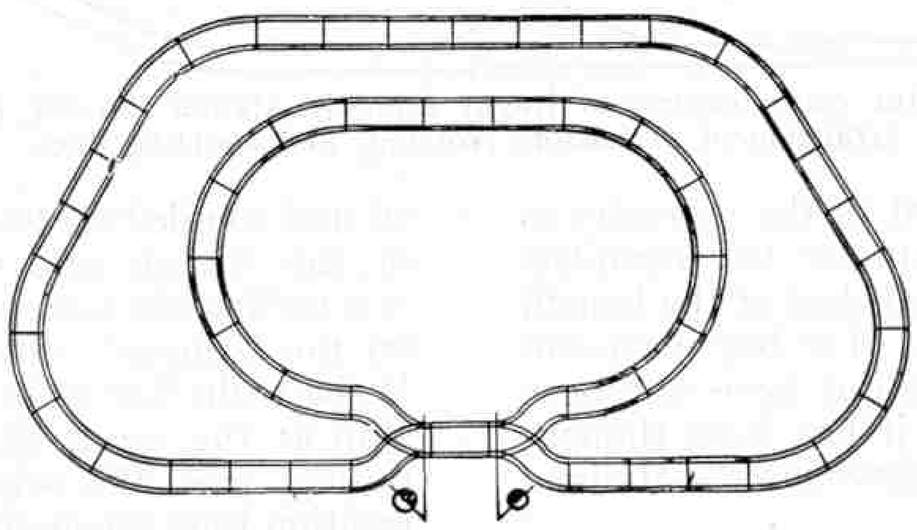


The Hornby "Harrogate Pullman" hauled by a "Shire" locomotive

The plan consists of two separate main lines with one single line section that is common to both. It will be seen that the possibilities of this layout are much greater than those of the layout shown in these pages last month. With the latter the use of two trains was possible, but one had to remain in the passing loop while the other was running round the main track. With this month's layout we shall be able to run both trains at once, although some care will need to be taken in regard to their running over the section of single track. The layout could be worked quite well by one operator, but two would make matters easier and much more interesting.

If two trains are not available the layout makes possible quite a number of entertaining evolutions with one train only. This may travel round the inner loop, for instance, and then be switched to the outer line, where perhaps it may stop at a station. Many similar movements will quickly occur to a keen operator. It will be noticed that the points used are the same as those shown in last month's layout, the only difference being that a few more rails are required.

The chief purpose of these diagrams is to show layouts that are complete in themselves, and yet at the same time are capable of extension and variation to suit individual requirements. For this reason we do not show any sidings. These often involve difficulties, especially where the system has to be laid down afresh each time it is used, and cannot have a special room allotted to it. We shall be glad to receive particulars of any variations to these layouts that H.R.C. members have tried with success.



Suggested Layouts (No. 5)

2′ Radius (as illustrated): 24 Curves, 22 Straights, Parallel Points (Right), Parallel Points (Left).

1′ Radius: 12 Curves, 17 Straights, Parallel Points (Right), Parallel Points (Left).

Some Suitable Loads for Goods Wagons

In operating any layout passenger trains should not be allowed to monopolise too much of the traffic. Goods trains are just as interesting as passenger trains and in one sense they are more so; for while it is very difficult to do much in the way of carrying miniature passengers, it is quite easy to transport an interesting variety of miniature freight. Even if a train consists only of three or four open wagons it looks far more interesting if loads of some kind are being carried.

Almost any material that is small enough can be used as freight. The Meccano Sacks look particularly effective in open wagons, and other suitable loads may be made up from such readily obtainable material as rice or dried peas. Very small pieces of coal also make very effective loads, and these need not be dirty if the pieces are washed and reasonable care is taken to avoid breaking them and so producing dust.

Many model railway enthusiasts are apt to neglect the introduction to their layouts of the smaller railway accessories. These undoubtedly add enormously to the interest and realism of any layout. For instance, the appearance of stations is vastly improved by arranging in suitable positions on the platform the Miniature Luggage and Truck, Milk Cans and Truck, and Platform Automatic Machines, etc., that are obtainable in the Hornby Railway Accessories, Sets Nos. 1, 2, and 3, or all together in Set No. 4.

Then there are the various lineside accessories. The Watchman's Hut, complete with brazier, shovel and poker (Set No. 7), gives a surprising touch of realism when placed in a suitable position, and the interest of the whole line is greatly increased by the use of Gradient Posts and Mile Posts (Set No. 5). There are also the notice boards, "Catch Points," "Whistle," "Shut off Steam," etc. (Set No. 8).

Telegraph Poles by the side of the line, placed at suitable distances apart and connected up by thread, look very attractive, and stations or goods yards are greatly improved by the addition of one or two Lamp Standards, either single or double. It should not be overlooked that miniature electric light bulbs may be fitted into the globes of these standards, and connected up by fine wire to a flashlamp battery. This should be placed in a convenient central position, and care should be taken to arrange the wires in such a manner that they do not interfere with operations.

XIII.—A GOOD LAYOUT FOR DISPLAY PURPOSES

LAST month we gave a brief description of Rugby Station and pointed out its suitability for reproduction in miniature, with certain simplifications. On this page we give a plan of the station, omitting the various junctions that were described last month, and also the connection of the Peterborough line. This last is an important link in the L.M.S. system, but it joins up to the main line in a manner that would be difficult to reproduce in a model railway. In order to avoid fouling the main line, as would be the case if an ordinary double junction were used, one of the Peterborough tracks approaching from the east joins up with the "down" main line by means of a flying junction. The other Peterborough track simply comes off from the "up" line.

We will now consider the station from a model point of view. Fig. 2 shows the modifications that are necessary in order to avoid unnecessary complications, while at the same time retaining the main features of the original. The layout is rather long on account of the necessity of providing enough length of platform for two complete trains. If this were not done a great deal of the benefit of this type of layout would be lost. The bay platforms at the south end of the actual station have not been included in the model layout, but it has been thought worth while to have the northern bays where the Midland Section branch trains are dealt with.

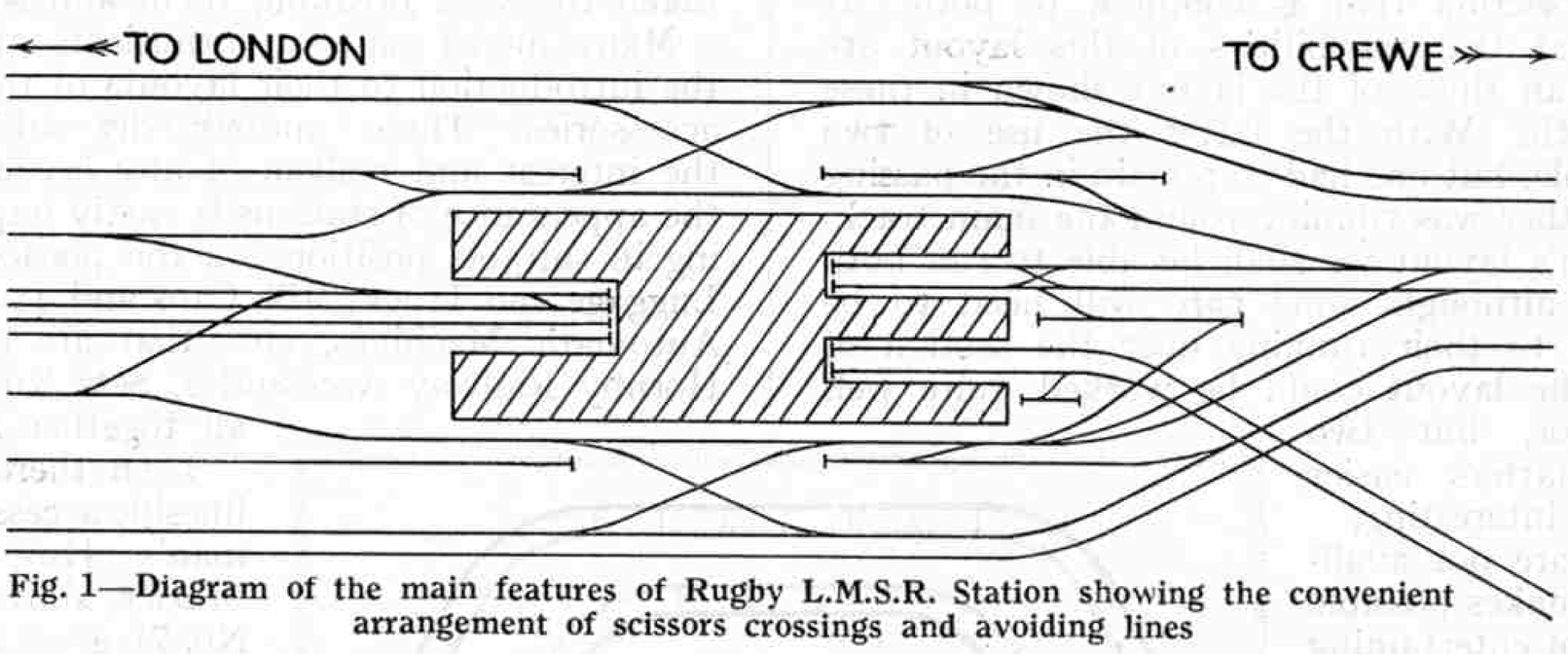


Fig. 1—Diagram of the main features of Rugby L.M.S.R. Station showing the convenient arrangement of scissors crossings and avoiding lines

A simple method of reproducing this connection is shown in the diagram. It will be seen that this branch is shown as being double track until near the diamond crossing over the main platform line, where the two tracks converge and enter the station as a single line. This arrangement will be found quite sufficient for dealing with branch traffic on a model system. If necessary, the branch could quite well be single track throughout.

Two crossovers will be noticed, one within the bay platforms near the buffer stops, and the other outside the station beyond the points where the main lines and bay lines converge. These will enable the branch line engine to run round its train upon arrival.

In a station of this kind, provided the various train movements are carefully worked out, the possibilities are almost endless. Thus, a goods train can quite reasonably be "refuged" between the points at the platform and the scissors crossing, while passenger operations are proceeding on the platform line. For example, a train may be standing at No. 1 platform (south) and the goods train on the "down" through line (north); and still a non-stopping train can easily pass by, taking the "down" through line and then crossing to the "down" platform line, and thus proceeding on its way.

Then again there are the possibilities of through working of traffic from the branch on to the main line. Let us assume that a van is attached to the rear of the branch train and is to be transferred to the main line. On arrival at the bay platform the engine will uncouple and run round the train by means of the crossovers to which we have already referred. The van will be detached and coupled up to the engine, which will then run out of the station and over the crossover. It will then reverse and the van may be left on No. 1 bay line, or even on the "down" through line just short of the points. If the main line train to which it is to be attached is to stop at the south end of platform 1, the van may be pushed past the scissors crossing and left in such a position that the engine of the main line train can easily pick it up and transfer it to its own train. After dealing with the van in this manner the branch engine can then return to its usual duties.

In the case of a van attached to the tail of an "up" train, the procedure is somewhat simpler. The engine of the branch train, or the station shunter or "pilot," as it is sometimes known, will come up in the rear of the main line train and take away the van and draw it out until clear of the bay line points. It can then, when these points are set, push the van on to the bay line, and if the branch line coaches are already there, the van will be attached at the head of them. If the platform is clear, the van may be left up by the buffer stops and will then be attached to the tail of the branch line train

when the latter has been shunted in.

To avoid complication we have not shown the locomotive depot or the siding accommodation at Rugby. As might be expected, this latter is very extensive, as the situation of Rugby, with lines converging upon it from seven directions, makes it an ideal centre for the interchange of traffic. Thus, in our miniature reproduction of the station we may include a well laid out goods and marshalling yard. The actual situation of this in respect to the model station will depend a good deal upon the space available and the "local circumstances" of the site of the model railway.

A good position would be perhaps to the North of the station, having points leading to the yard beyond the crossover shown; or better still, if it is possible, the "down" platform avoiding line might have points from which it could continue straight on as well as run into the platform line itself. If this were done, and the connection thus made between the yard and the main line were supplementary to the entrance points mentioned before, much of the nuisance caused by the "bottle neck" between the station end and the yard would be avoided. Then a "down" goods train bound for the yard would be able to take the platform avoiding line at the station and run straight into the goods "reception road" without interfering in any way with a passenger train or trains standing at the "down" platform.

If the yard layout were not continuous, that is to say, if the various tracks ended at buffer stops at the North end, then a "down" train, in order to shunt, would have to be stopped on the platform avoiding line. The locomotive would uncouple and run round the train—which could be done by "wrong road working" along the platform line—and then push the train into the sidings and carry out the shunting movements required.

A far better arrangement, of course, would be a yard of the "through" type; that is, one with a connection to the main line at the North end. Then our "down" goods train would be able to run right in and shunting could be carried out without any running round being necessary. A great advantage also would be that an "up" goods train would be able to enter the yard at the North end in the proper direction, having first crossed from the "up" to the "down" line by means of a facing crossover, which would certainly be provided in such a situation. Thus goods traffic in both directions could be handled with reasonable speed and without much interference to other traffic, provided due care be taken in the running arrangements.

Carriage sidings might well be arranged in the same way as the goods yard, as this arrangement of roads will enable the station "carriage-pilot" to deal with the coaching stock easily and quickly. In model railway work a very good plan is to have the various passenger coaches made up as "set trains." This practice is coming more and more into general use on real railways, even for important expresses; and is one that may very well be imitated on a miniature system.

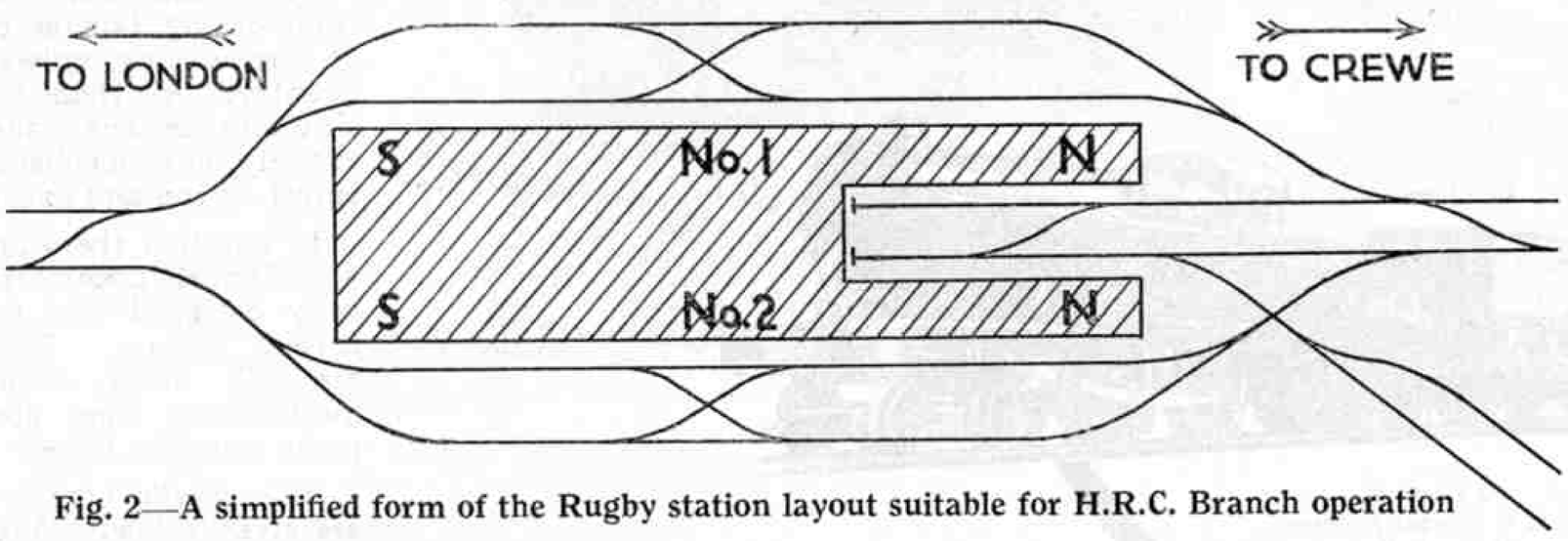
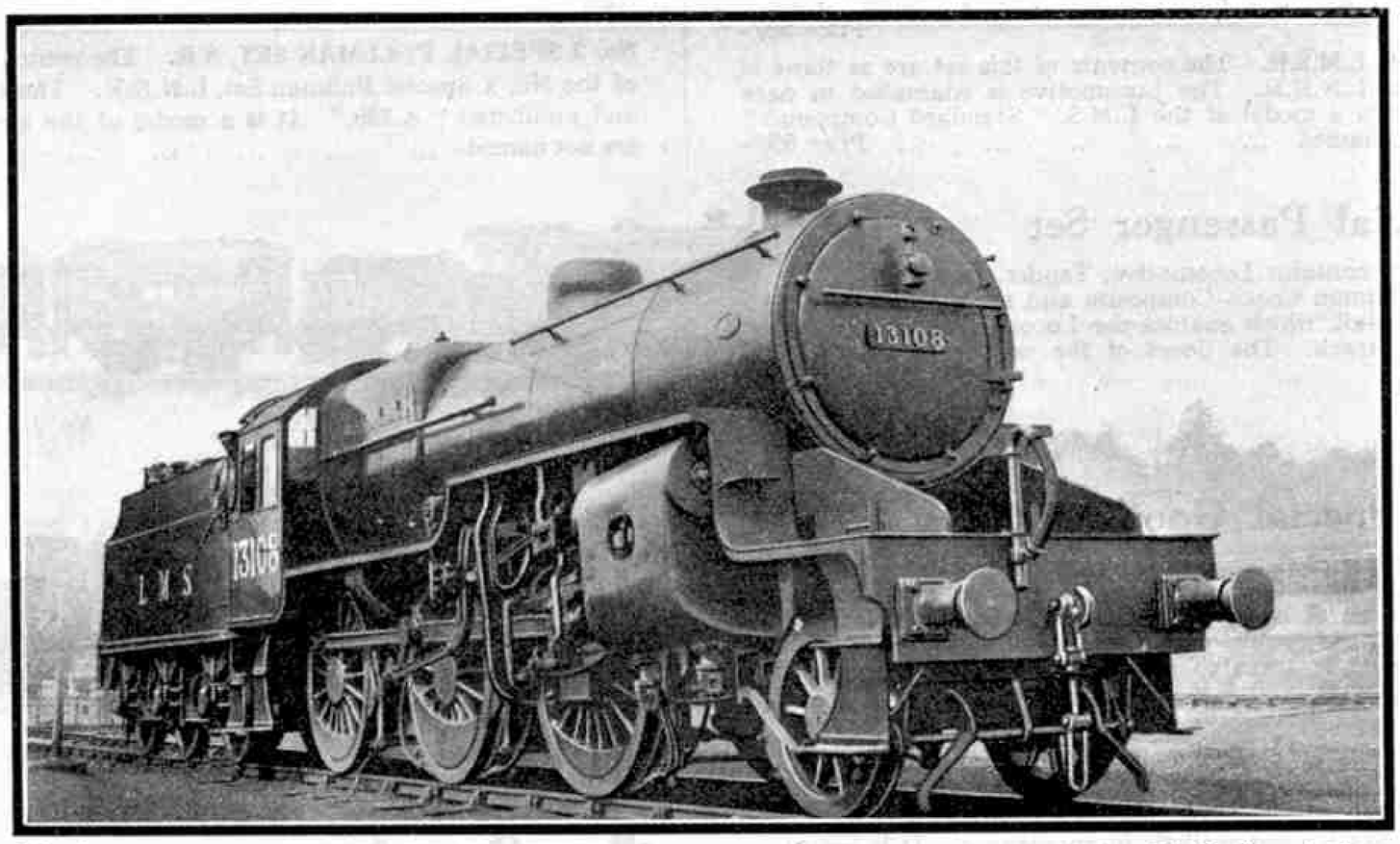


Fig. 2—A simplified form of the Rugby station layout suitable for H.R.C. Branch operation

It saves a great deal of shunting of individual coaches in order to make up a train, for if each train of say three or four coaches is treated as a unit and generally kept coupled together, there is much saving of time in the preparation of various services and, of course, a reduction of shunting engine movements, which will commend the practice to the "Chief Controller." Thus, if the carriage sidings are laid out in such a way that each road will hold one complete train, and the trains themselves are kept as far as possible in sets, then the various services may be run with the greatest of ease and the disposal of the empty trains on the completion of their duty is a simple matter.

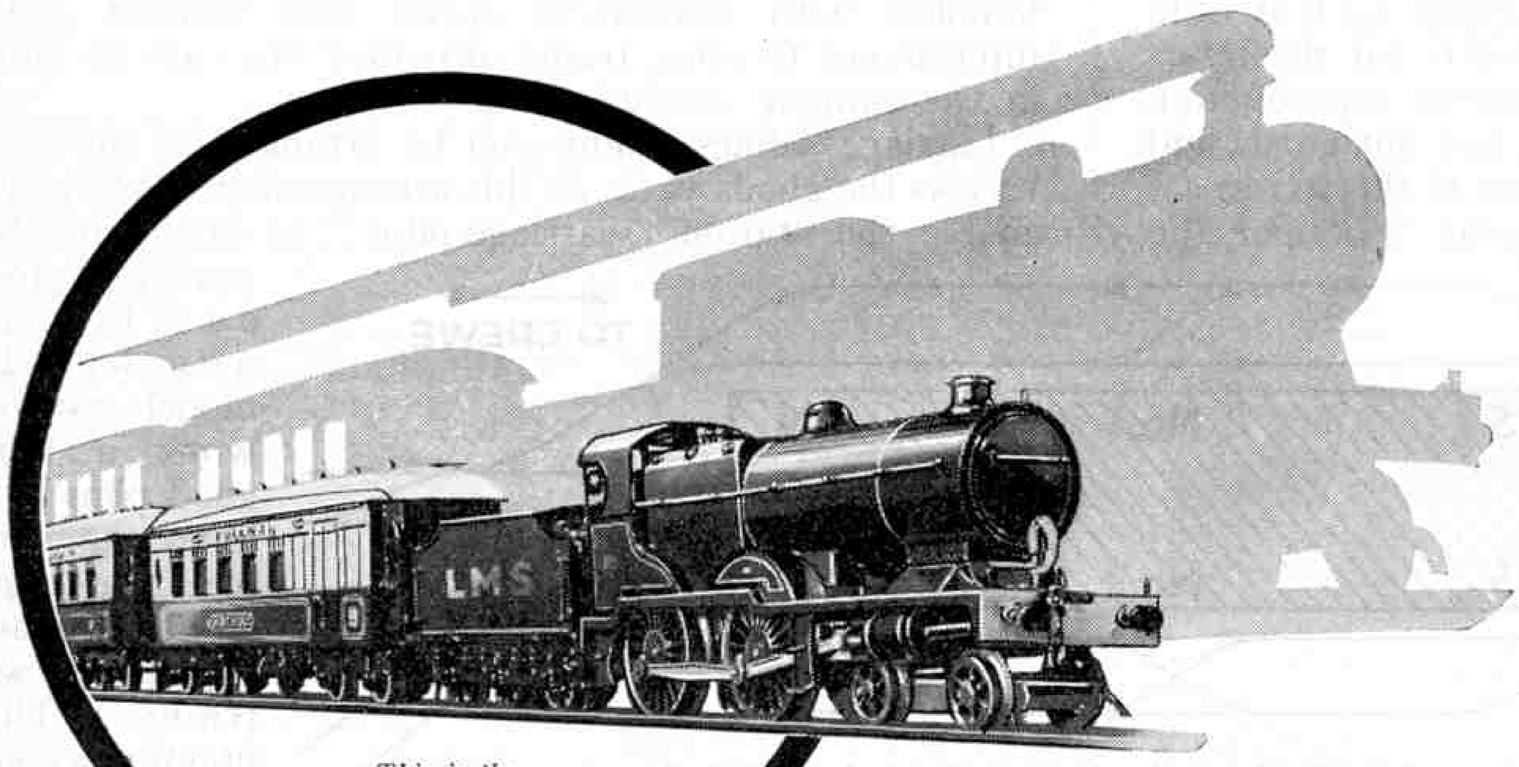


Photo] [*J. J. Cunningham*

L.M.S. "Mogul" No. 13108. This is a General Purposes Locomotive of the type referred to in this article

A suitable site for the model locomotive depot would be on the "up" side of the line in a corresponding position to the goods yard. This arrangement would keep the whole layout fairly compact, and without the straggling sidings and branches here and there that are so often seen on model railways. In this way the locomotives would be able to reach the station or the yard easily and quickly. In providing locomotive power for the various services care should be taken not to have too many express locomotives. They are necessary, of course, but it is the "general purposes" locomotive that is almost indispensable on a model system, even more so than its full-size representative on the real railways.

NEW HORNBY TRAINS



This is the No. 2 Special Pullman Train L.M.S.

The year 1929 will be an outstanding year in the history of Hornby Trains, for it marks the introduction of a range of new locomotives that are the last word in efficiency and realism.

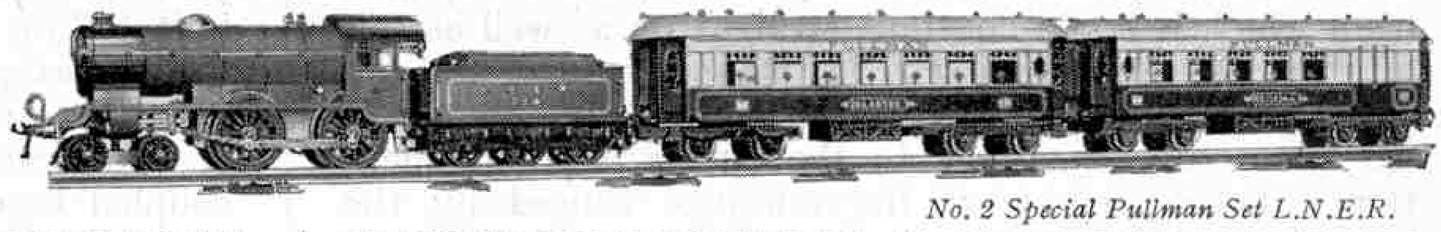
There are four "true-to-type" models representing famous classes in the services of the leading railway companies in this country. All these locomotives have been carefully designed and are fitted with an entirely new mechanism that gives great length of run and exceptional pulling power.

In addition there are splendid new Tank and Tender Locomotives that are realistically designed and beautifully finished in correct colours. These locomotives, too, are all fitted with greatly improved mechanisms that give longer runs and make possible bigger loads.

Full details of the new Hornby Trains are given below. Ask your dealer to show you specimens.

No. 2 Special Pullman Sets

"True-to-type" Models



No. 2 Special Pullman Set L.N.E.R.

No. 2 SPECIAL PULLMAN SET, L.N.E.R. This set contains Locomotive, Tender, No. 2-3 Pullman Coach, No. 2-3 Pullman Coach Composite and set of Rails, including a Brake and Reverse Rail, by means of which the train may be braked or reversed from the track. The Locomotive, which is enamelled in green, is named "Yorkshire," and is a model of the famous "Shire" class. Price **55/-**

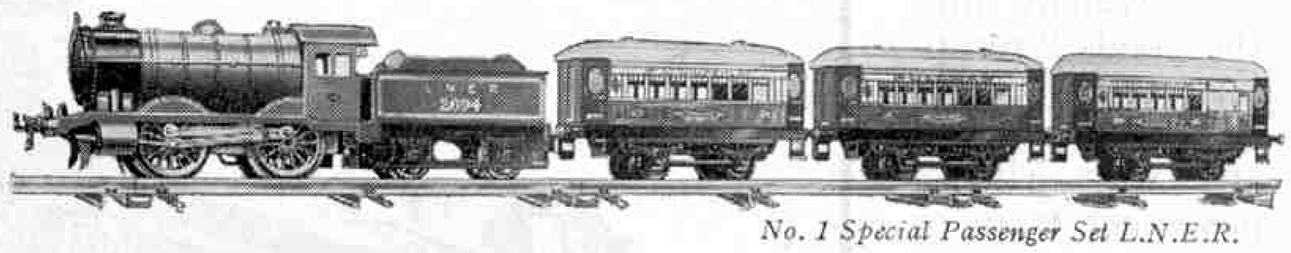
No. 2 SPECIAL PULLMAN SET, L.M.S.R. The contents of this set are as those of the No. 2 Special Pullman Set, L.N.E.R. The Locomotive is enamelled in dark red and numbered "1185." It is a model of the L.M.S. "Standard Compound" class locomotives, which are not named ... ... Price **55/-**

No. 2 SPECIAL PULLMAN SET, G.W.R. The contents of this set are as those of the No. 2 Special Pullman Set, L.N.E.R. The Locomotive, which is enamelled in Great Western green, is named "County of Bedford." It is a model of the famous "County" class ... ... Price **55/-**

No. 2 SPECIAL PULLMAN SET, S.R. The contents of this set are similar to those of the No. 2 Special Pullman Set, L.N.E.R. The Locomotive is enamelled in green and numbered "A.759." It is a model of the new "L" class locomotives, which are not named ... ... Price **55/-**

No. 1 Special Passenger Set

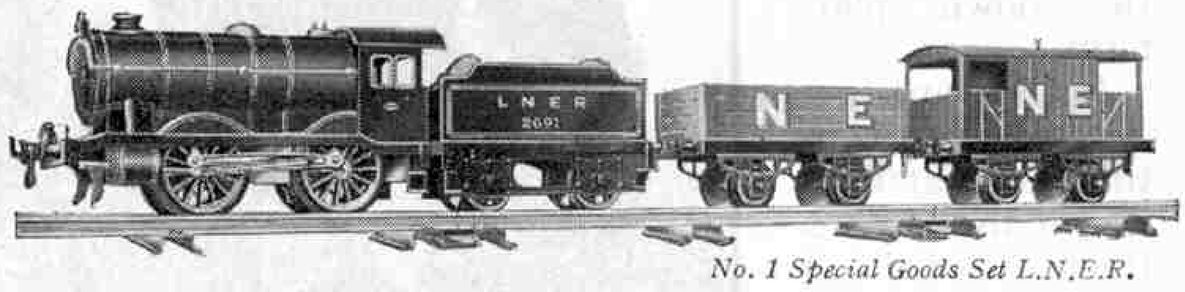
The No. 1 Special Passenger Set contains Locomotive, Tender, two No. 1 Pullman Coaches, one No. 1 Pullman Coach Composite and set of Rails, including a Brake and Reverse Rail, which enables the Locomotive to be braked or reversed from the track. The doors of the coaches open. Gauge 0 ... ... Price **32/6**



No. 1 Special Passenger Set L.N.E.R.

No. 1 Special Goods Set

This set is similar to the No. 1 Special Passenger Set, but contains one Wagon and one Brake Van in place of the Pullman Coaches. The Locomotive and Tender are supplied in the regulation goods traffic colours—black for L.N.E.R., L.M.S.R. and S.R., and dark green for G.W.R. If required, the set may be obtained with the Locomotive and Tender in passenger train colours—green for L.N.E.R., red for L.M.S.R., and dark green for G.W.R. and S.R. Gauge 0 ... ... Price **30/-**

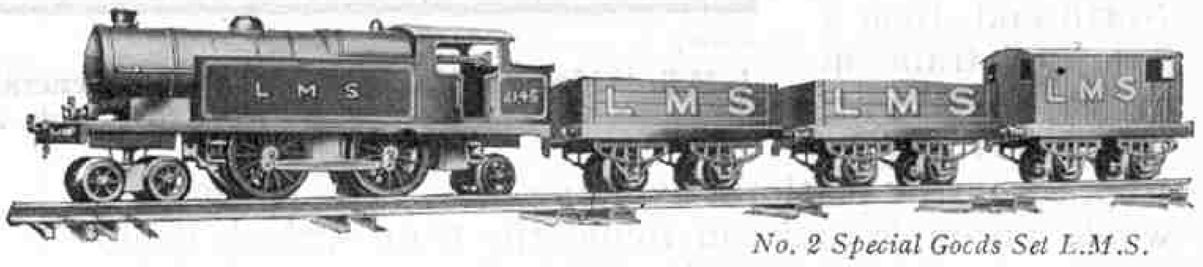


No. 1 Special Goods Set L.N.E.R.

No. 2 Special Goods Set

This handsome clockwork Train Set is most realistic in appearance. It is beautifully designed and finished, and is hauled by a fine 4–4–2 Tank Locomotive of great power and speed. Each set contains No. 2 Tank Locomotive, two Hornby Wagons, Brake Van and set of Rails, including a Brake and Reverse Rail, by means of which the Locomotive may be braked or reversed from the track.

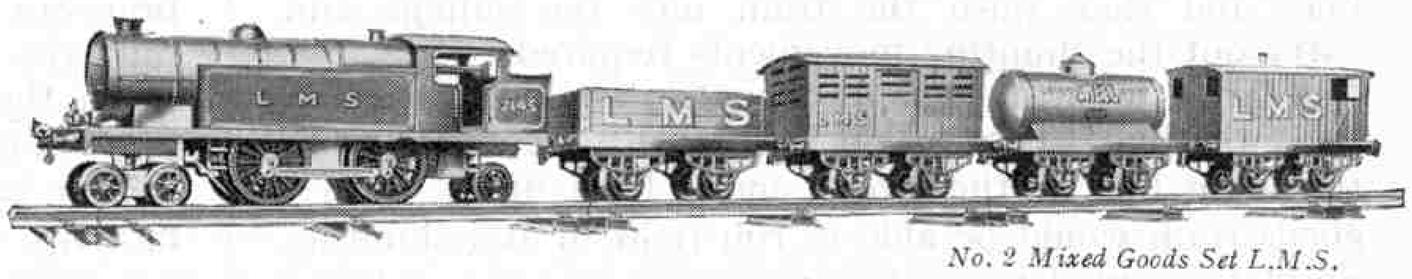
The Locomotive is supplied in the regulation goods traffic colours—black for L.N.E.R., L.M.S.R. and S.R., and dark green for G.W.R. If required, the set may be obtained with Locomotive in passenger train colours—green for L.N.E.R., red for L.M.S.R., and dark green for G.W.R. and S.R. Gauge 0 ... Price **35/-**



No. 2 Special Goods Set L.M.S.

No. 2 Mixed Goods Set

This realistic Goods Train consists of the new 4–4–2 Tank Locomotive, as supplied with No. 2 Special Goods Set, Hornby Wagon No. 1, No. 1 Cattle Truck, Petrol Tank Wagon, Brake Van and set of Rails, including a Brake and Reverse Rail, by means of which the Locomotive may be braked or reversed from the track. The Locomotive is supplied in the regulation goods traffic colours—black for L.N.E.R., L.M.S.R. and S.R., and dark green for G.W.R. If required, the set may be obtained with Locomotive in passenger train colours—green for L.N.E.R., red for L.M.S.R., and dark green for G.W.R. and S.R. Gauge 0 ... ... Price **37/6**



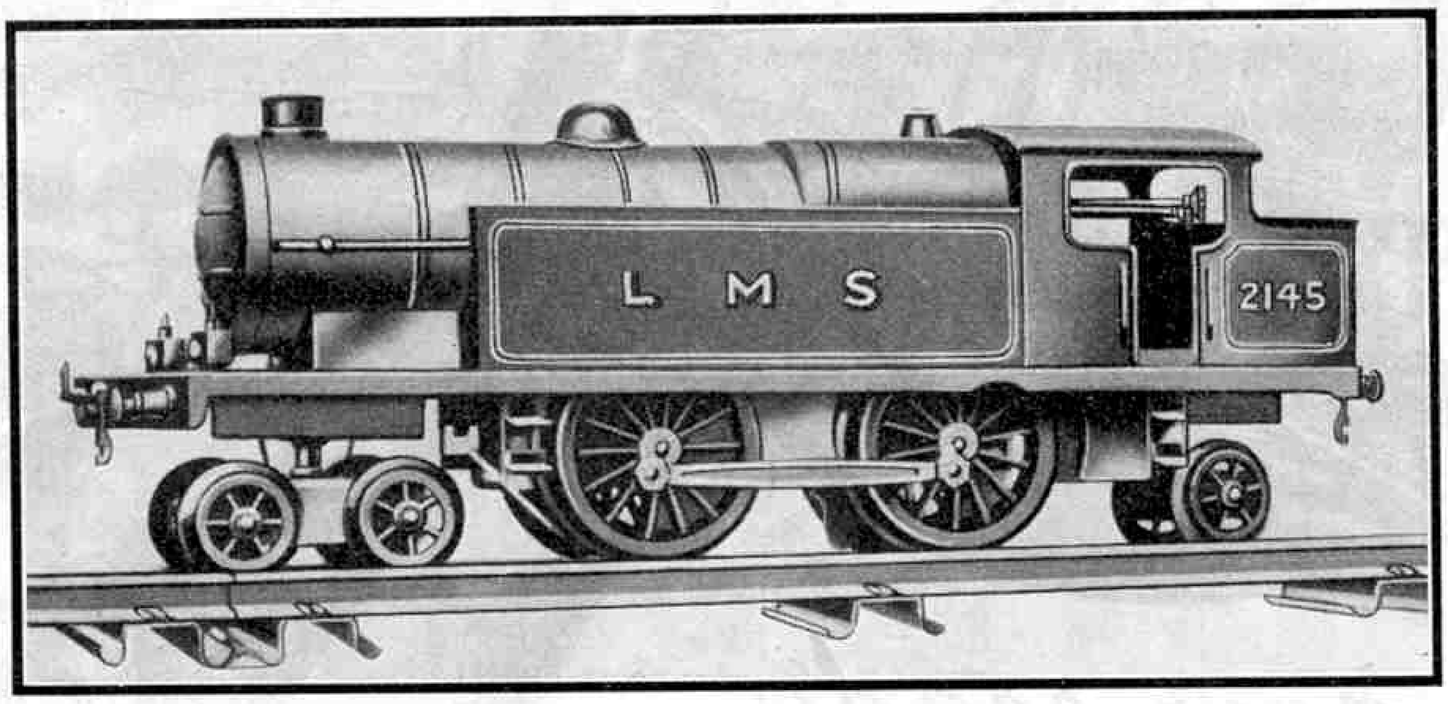
No. 2 Mixed Goods Set L.M.S.

Manufactured by MECCANO LIMITED OLD SWAN LIVERPOOL

New Locomotives of the Hornby Series

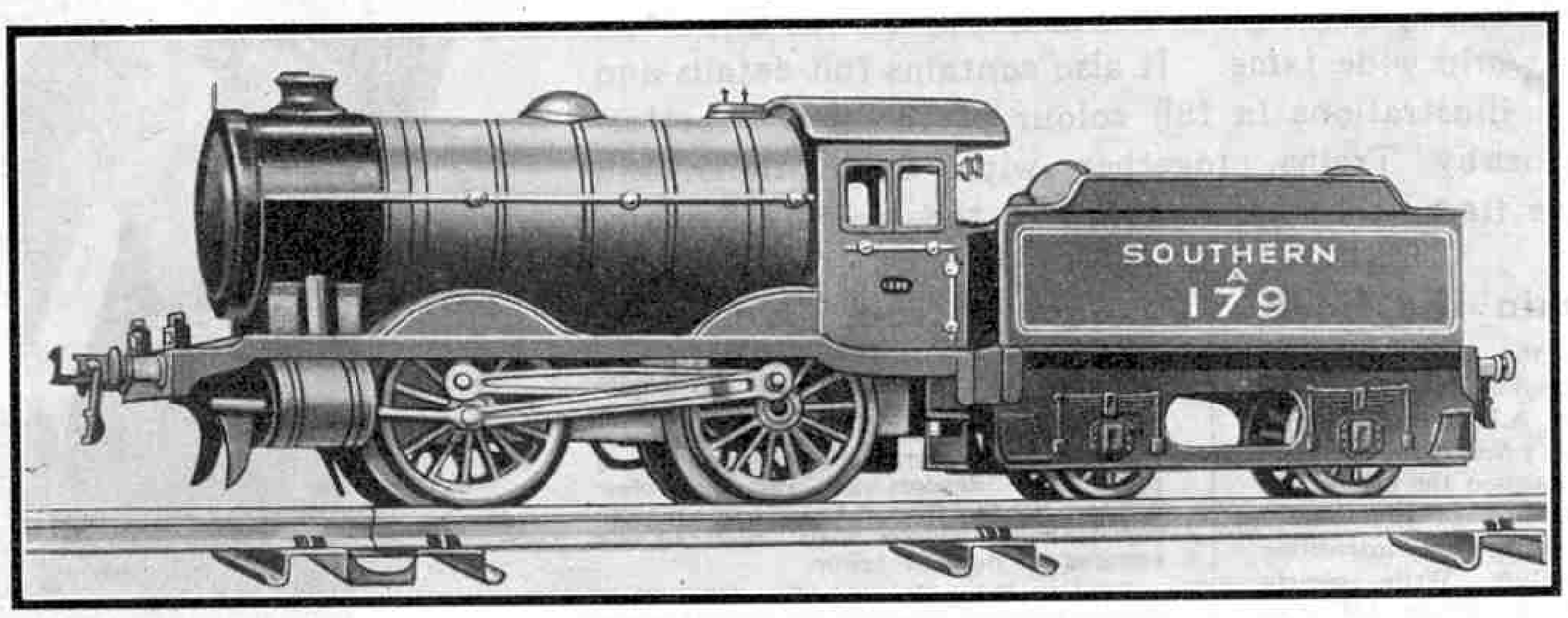
By 'Tommy Dodd

IN my last article I dealt with the new Hornby No. 2 Special Passenger Locomotives. In addition to these fine models there is the No. 2 Special Tank Locomotive, specially designed for mixed traffic. This locomotive, which is fitted with the same mechanism as those previously described, has the 4–4–2 wheel arrangement. Examples of tank locomotives of this type are to be seen on all four railway groups, and they have been successfully employed for many years on a great variety of heavy-duty work. In particular may be mentioned the 4–4–2 superheater tanks of the former London, Brighton and South Coast Railway—now the Southern — which used to take their turn in working the luxurious Pullman train "*Southern Belle.*" This was anything but an easy task for a locomotive of such moderate dimensions.



Hornby No. 2 Special Tank Locomotive

This No. 2 Special Tank has a Belpaire firebox, and thus conforms to the general tendency in modern practice. It will form a useful addition to the locomotive stud of any Hornby railway as it is suitable alike for light freight traffic and medium-speed main line passenger work. The engine is supplied in the regulation goods traffic colours — black for L.N.E.R., L.M.S.R., and S.R., and dark green for G.W.R. If required this engine may be obtained also in the passenger train colours of any of the four groups.



Hornby No. 1 Special Passenger Tender Locomotive

Another interesting addition to the Hornby Series is the No. 1 Special Tender Locomotive. This is an extremely useful engine for mixed-traffic duty, and for this reason it is available in either the passenger or goods colours of each of the four groups. It is fitted with a greatly improved clockwork mechanism, giving ample hauling power in conjunction with a great length of run. In its superstructure it conforms to modern ideas in the way of reduced boiler mountings made necessary by the large boiler, outside steam pipes, Ross "Pop" safety valves, etc. The tender is entirely new and has several special features. The wheels are die-cast and are of the spoked type fixed on axles that run in proper axleboxes. The inside is correctly fitted up with tanks and division plates for enclosing the coal space. Steps also are a feature, and a spring drawbar is provided for coupling to the locomotive.

The corresponding No. 1 Special Tank Locomotive has the same mechanism and general characteristics. It is an ideal engine for shunting purposes.

Another newcomer to the Hornby Series is the No. 1 Electric Tank Locomotive. This is a particularly interesting little engine and one to which I wish to draw special attention. In design it follows closely the lines of the very popular Hornby No. 1 Tank, the main difference being that it is fitted with a 6-volt permanent magnet motor instead of clockwork mechanism.

The most important feature of this type of motor is that it may be reversed by the simple operation of reversing the direction of the current. This enables the engine to be started, stopped, re-started or reversed, and also run at any desired speed, by the manipulation of the control switch at the side of the track. The engine is thus under complete control in every respect, and there is no necessity to handle it in order to carry out any desired movement. For this reason the engine is particularly suitable for shunting operations, and by means of it very interesting and realistic operations may be carried out.

The engine is supplied with a terminal connecting plate, a speed and reverse control switch, and 3 ft. of flex, and it is available in the colours of each of the four groups. The Meccano 6-volt accumulator is specially recommended for running this engine.

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The biggest, best and most thrilling Hornby Book of Trains ever issued is now ready. Boys! get your copy to-day.

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There is a special edition of the Hornby Book of Trains for Overseas, and copies have already been despatched to our agents to fill orders received. The price Overseas is 6d. post free (Canada 10 cents or 12 cents post free). Readers in Australia, New Zealand, South Africa or Canada who require copies should address their orders to our agencies as detailed below.

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H.R.C. COMPETITION PAGE

Competitions appearing on this page are open only to members of the Hornby Railway Company. Envelopes containing entries should have the title of the competition clearly written in the top left hand corner and should be addressed to the Hornby Railway Company, Binns Road, Old Swan, Liverpool. The name, address and membership number of each competitor should appear in clear writing on every sheet of paper used.

A New Word-Finding Contest

THE keen interest that has been taken by H.R.C. members in the railway problems that have been set before them month by month is very gratifying and encourages us in the difficult task of devising new schemes with which to perplex them. The numerous entries for the "Missing Links" Contest set out on this page of the April "*M.M.*" proved that word-building and word-finding problems are as popular with model railway enthusiasts as they are among "*M.M.*" readers in general. This month, therefore, we again give every H.R.C. member an opportunity of combining his knowledge of railway working with his skill in word-finding.

Can you discover the 16 hidden railway terms, with the aid of the clues given in the right-hand column?

Hidden Words	Clues
– x – – x – – , – x x –	For preventing wheel-slip.
– x – x – , – x – x x –	Contained in the boiler when under pressure.
– x – – x	For controlling purposes.
– x x – x	To which things must conform.
– x – – x – x – x x –	Reduces machinery wear.
– x – – x –	Artificial passage.
– – – x – x – x	Details of line operation.
– – x x – –	Part of main frame of a locomotive.
– – x – – , – x – – –	Name of a mighty L.M.S. locomotive.
x – – x – x x –	Essential quality of a powerful locomotive.
x – x x – , – x – –	A unit in Walschaerts Valve Gear.
– – x – , – x x – – x –	Used largely on the G.W. Rly. System.
– x – x – x – x x –	Name of an early locomotive.
– x – x – –	Used often in fitting crank-pin bearings.
– – x – – x – –	Line clearing.
– – x – – x – – – x –	Name of a L.N.E.R. Express locomotive.

In the centre of this page is a panel containing, on the left, a column of mysterious dashes and crosses. Each of these marks represents the letter of a word, and it will be noticed from the list of clues in the right hand column that in every case the missing word relates to railway matters. In each case the total number of dashes and crosses is the same as the total number of letters in the word, each dash representing a consonant and each cross a vowel. In some instances the answers consist of two words, and in these cases a comma indicates the completion of the first word.

No attempt should be made to solve the contest on the page of the Magazine. The list should be copied out on to a large sheet of paper and then worked out item by item. When as many as possible of the lines have been solved the competitor's name, address and membership number should be written clearly on the sheet, which should be put in an envelope and sent to Headquarters, marked "H.R.C. Word-finding Contest" in the top left-hand corner.

It should be remembered that the omission of the H.R.C. membership number from any entry will cause it to be disqualified immediately.

The competition will be divided into two sections —Home and Overseas. Prizes of Hornby Goods (or Meccano if preferred) to the value of £1-1s. 15/–, 10/6 and 5/– respectively, will be awarded to the four competitors in each section who submit the most complete lists. In addition, a number of consolation prizes will be awarded to the best of the remaining entries.

Envelopes should be plainly addressed and should be posted to reach Headquarters at Binns Road, Old Swan, Liverpool, on or before 30th November. The closing date for the Overseas Section is 28th February, 1930.

H.R.C. Voting Contest

The issues of a popular magazine such as the "*M.M.*" are planned many months ahead of publication date, and already many articles, as interesting as they are varied, are being prepared for publication during 1930. We can safely prophesy that next year the "*M.M.*" will be better than ever!

One matter, however, that is still being debated in the Editorial sanctum is that of H.R.C. Competitions to be held during next year. The discovery of original subjects is no easy task, and to help us in deciding what particular type of Contest is most popular with the majority of H.R.C. members we have decided to announce this month a Voting Competition, dealing with the various problems that have appeared on this page month by month.

Every entrant for the Competition is required to state:—

(1) Which of the Contests is his favourite.
(2) What he considers will be the eight most popular Contests in the order of their popularity. It should be noted that competitors need not necessarily include in this forecast the Contests that happen to be their own personal favourites.
(3) A description of any Contest that has not been dealt with so far and which would be suitable for inclusion on this page.

With regard to item 3, competitors will probably find it necessary to supplement their description with a small drawing. Any entrant who is not good at drawing need not fear that this fact will be counted against him in the contest, provided the drawing conveys his idea clearly enough.

Prizes of Hornby Goods (or Meccano, if preferred) to the value of £1/1/–, 15/–, 10/6 and 5/– respectively, will be awarded to the four competitors who give the most accurate forecasts of the final order of voting. In the event of a tie for any of the prizes preference will be given to the entry displaying the neatest or most novel presentation. In addition, there will be a number of consolation prizes.

The competitors' name, address, and H.R.C. number must be clearly written on the back of every sheet submitted, and envelopes should be marked "H.R.C. Voting Contest," in the top left-hand corner. Closing date, 30th November.

COMPETITION RESULTS

Home

August "A Locomotive Knowledge Test."—First: L. T. Levitt (7965), Swansea. Second: J. F. Riley (7987), Beckenham, Kent. Third: I. G. MacMillan (4442), Midlothian. Fourth: C. P. Phillips (2595), Devon. Consolation Prizes: E. E. Lambert (2465), Birmingham; W. Cowlishaw (9798), Swindon; F. W. D. Hawkins (5352), Lewes; R. W. Deacon (9052), E. Acton, London, W.3.

September "Locomotive Problem" Competition.—First: Fergus Byron (1347), Nottingham. Second: W. K. Tomlinson (10007), Blackpool. Third: W. H. Crowhurst (9793), Surbiton. Fourth: W. Cowlishaw (9798), Swindon. Consolation Prizes: S. G. Woodford (8961), London; E. Crilley (5970), Paisley; C. J. Bacon (9526), Blackpool; W. A. Spurr (2161), Kegworth; D. W. Hales (3428), Eastbourne; J. W. Boulton (9873), Stoke-on-Trent.

Overseas

April "Missing Locomotive Links" Competition.—First: Gnana Durai (1964), Trichinopoly, India. Second: Walter Fagg (8557), Otago, New Zealand.

June "Locomotive Link" Competition.—First: P. L. Bargellini (8388), Florence (28). Second: W. Fagg (8557), Otago, New Zealand. Third: M. R. Thompson (7497), Jamaica.

July "Signalling" Competition.—First: R. A. Wragg (7913), India. Second: I. T. G. Johnstone (8817), Otago, New Zealand. Third: C. W. Dover (7893), India. Fourth: F. Van Bulck (1875), Belgium. Consolation Prizes: F. E. Mills (9375), S. India; J. A. Rodriquez (3647), Canada.

I SAY, FATHER!

HERE'S A REALLY FINE PLAY GUN

—a gun which looks and works like a real sporting gun. The FOX PLAY GUN has double steel barrels which " break " for loading at the breech just like a man's gun. You load it by putting two spring cartridges in the breech and pressing a small wooden ball into each cartridge. There are two triggers, of course, one for each barrel, and the balls travel with enough force to give you accurate target practice indoors or out-of-doors, but they can't hurt anybody or anything.

Just tell Daddy that!

Looks like a real Gun, Works like a real Gun, but is Perfectly HARMLESS.

Show this advertisement to Father and tell him what hours of fine fun you could have (he also) with this splendid Play Gun. A strong bell target comes with each Gun together with two cartridges and a good supply of balls.

FOX PLAY GUN

DOUBLE BARREL BREECH LOADING

From all high-class Toy Dealers and Stores Price 17/6

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The realistic Ship's Funnel, Cunard type, introduced recently, has proved so extremely popular that we have decided to introduce 24 additional funnels representing those of nearly all the principal Shipping Companies. Four of the new funnels are described below and in subsequent issues of the "*M.M.*" we propose to deal similarly with the others in the range.

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Jacobs, John I. & Co. Ltd.
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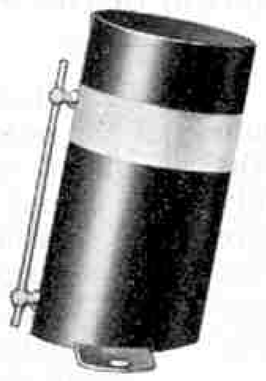

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"Lynx-Eye" Competition Results

THIS month we have pleasure in publishing the lists of prize-winners in both sections (Home and Overseas) of the Second and Third Lynx-Eye Contests, together with the results in the "Home" Section of the Fourth Contest. The names of the prize-winners in the Overseas Section of the latter contest, together with the list of special awards to those boys who have secured a prize in each of the four contests of the series, will be announced in an early issue of the *"M.M."*

In each contest several competitors succeeded in solving all the puzzle pictures, and accordingly the prizes were allotted in rotation to the senders of the first correct solutions examined. Under this system the various prizes were secured by the competitors named in the following complete lists:—

Second "Lynx-Eye" Contest, Home Section:—

FIRST PRIZE (Meccano or Hornby goods to value £1-1s.): Derrick Ruffle, West Bergholt, Essex. SECOND PRIZE (Meccano or Hornby goods to value 15/–): J. C. Prosser-French, Tonbridge; THIRD PRIZE (Meccano or Hornby goods to value 10/6): R. F. Nicholas, Portsmouth.

TWELVE PRIZES, each consisting of a copy of "Famous Trains" by C. J. Allen. Stuart Taylor, Crouch End, London, N.8; J. C. Button, Crewe; G. H. Thomas, Purley; G. Kynch, W. Croydon; W. Basil Williams, Blandford; John A. Young, Grimsby; Mark Robinson, Stainforth, near Doncaster; G. Weightman, Monks Park, Wembley; B. H. Moloney, Cheltenham; Philip D. Banks, Dunstable; George Effemey, Bransgore, Christchurch, Hants.; David Farnen, Stoneycroft, Liverpool.

Overseas Section:—

FIRST PRIZE (Meccano or Hornby goods to value £1-1s.): Walter Pols, Antwerp, Belgium; SECOND PRIZE (Meccano or Hornby goods to value 15/–): Akbaralli Abdulrahim, Karachi, India. THIRD PRIZE (Meccano or Hornby goods to value 10/6): D. D. Grieve, Bloemfontein, S. Africa.

TWELVE PRIZES, each consisting of a copy of "Famous Trains": J. A. Gomes, Bombay, India; J. J. Minnaar, Cape Town, S. Africa; C. J. McCain, Sydney, N.S.W., Australia; F. Khandwalla, Karachi, India; James Wilson, Wellington, New Zealand; B. D. Joshi, Almora, India; C. Williams, Melbourne, Australia; R. B. McMillan, Melbourne, Australia; James Lyons, Penang, S.S.; J. A. Rodriguez, Montreal, Canada; Jack Tanner, Sydney, Australia; J. C. Rishworth, Kolar Gold Fields, India.

Third "Lynx-Eye" Contest
Home Section:—

FIRST PRIZE (Meccano or Hornby goods to value £1-1s.): K. King, Hull. SECOND PRIZE (Meccano or Hornby goods to value 15/–): Henry L. McMillan, Baschurch, Shrewsbury. THIRD PRIZE (Meccano or Hornby goods to value 10/6): W. Wright, Chryston, near Glasgow.

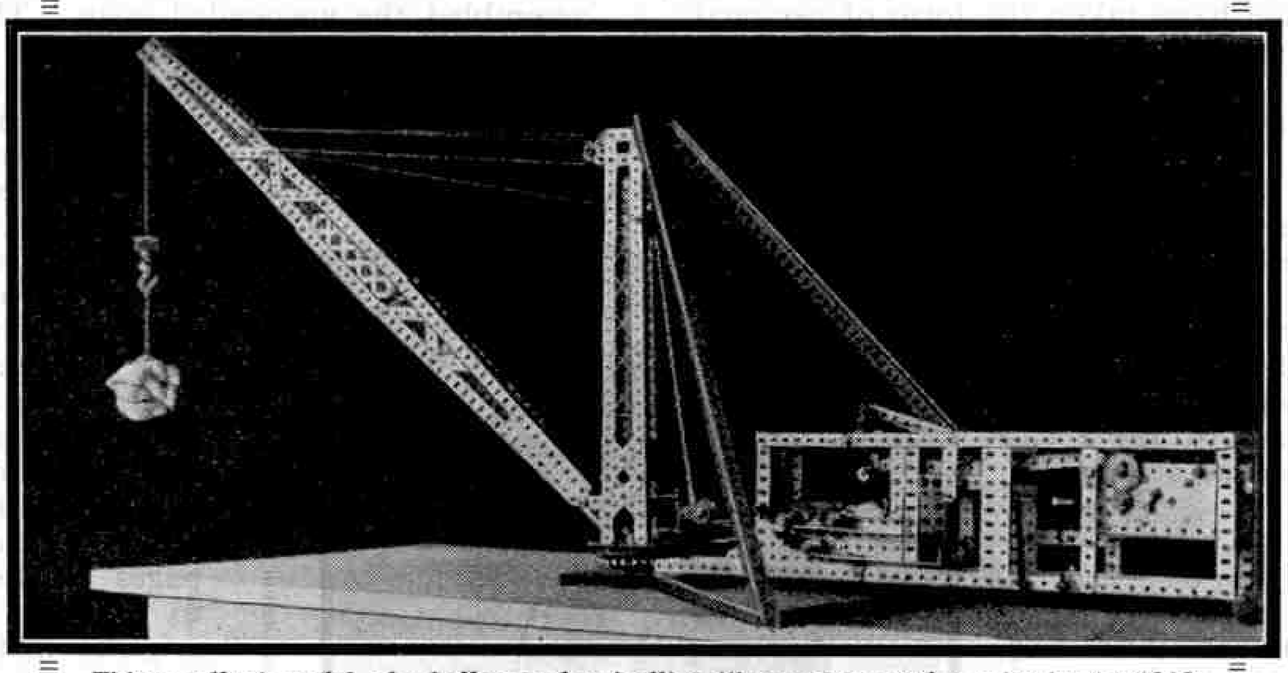
TWELVE PRIZES, each consisting of a copy of "Famous Trains" by C. J. Allen: J. V. McGann, Ennis, Co. Clare; Stanley H. Judson, London, N.W.5; Leslie Williams, Ramsgate; R. F. Nicholas, Portsmouth; J. C. Button, Crewe; Ernest H. Bradshaw, Sheffield; George Effemey, Christchurch, Hants.; G. Kynch, W. Croydon; W. Basil Williams, Blandford, Dorset; John Young, Grimsby; Gordon B. Weightman, Monks Park, Wembley; Alister Lonnon, Kensington, London, W.8.

Overseas Section:—

FIRST PRIZE (Meccano or Hornby goods to value £1-1s.): Miss C. Gonsalves, Bombay, India. SECOND PRIZE (Meccano or Hornby goods to value 15/–): J. Minnaar, Cape Town, South Africa. THIRD PRIZE (Meccano or Hornby goods to value 10/6): C. Williams, S. Melbourne, Victoria, Australia.

TWELVE PRIZES, each consisting of a copy of "Famous Trains": R. Russell, Kara, Whangarei, New Zealand; W. Russell, Whangarei, New Zealand; D. B. Joshi, Almora, India; M. Morgan, Cremorne, Sydney, Australia; D. J. Mehta, Bombay, India; D. Grieve, Bloemfontein, S. Africa; J. A. Gomes, Bombay, India; John Buckell, Montreal, Canada; James Wilson, Wellington, New Zealand; A. Abdulrahim, Karachi, India; James Lyons, Penang, Straits Settlements; H. Wicke, Manly, Sydney, Australia.

A Meccano Crane with Torque Converter Drive



This excellent model of a luffing and swivelling jib crane secured a prize in the 1928 First Summer Model-building Contest for R. Earp (Sydney, Australia). A novel feature of the model is the addition of Constantinesco torque converter mechanism, which enables the crane to lift varying loads without altering the gear ratio between the Motor and winding mechanism. Moreover, the gear saves a considerable amount of time, for it automatically speeds up hoisting operations when only a light load is being handled

Fourth "Lynx-Eye" Contest

Home Section:—

FIRST PRIZE (Meccano or Hornby goods to value £1-1s.): G. Effemey, Christchurch, Hants. SECOND PRIZE (Meccano or Hornby goods to value 15/–): L. Williams, Newington, Ramsgate. THIRD PRIZE (Meccano or Hornby goods to value 10/6): Stuart Taylor, Crouch End, London, N.

TWELVE PRIZES, each consisting of a copy of "Famous Trains" by C. J. Allen: J. C. Button, Crewe; Harry P. Thornton, London, N.W.10; George Charlton, Eltham; Philip D. Banks, Dunstable; Ernest H. Bradshaw, Sheffield; G. S. Marsh, Blackpool; W. Wright, Chryston, near Glasgow; Francis O'Connell, Walton, Liverpool; Harry McMillan, Baschurch, Shrewsbury; C. E. Wrayford, Teigngrace; W. Raybould, Walsall; G. Kynch, W. Croydon.

Solutions to the Problem Pictures

The solutions to the various sets of pictures, showing the 1929 Manual numbers of the models from which the fragmentary pictures were taken, are as follows:—

Second Contest (published in the May *"M.M."*):—
Fig. 1, Model No. 4.42 (Fig. 4.42c); Fig. 2, Model No. 00.14; Fig. 3, Model No. 4.37; Fig. 4, Model No. 6.31; Fig. 5, Model No. 1.25; Fig. 6, Model No. 6.4; Fig. 7, Model No. 1.21; Fig. 8, Model No. 6.9; Fig. 9, Model No. 7.21; Fig. 10, Model No. 2.44 (Fig. 2.44b); Fig. 11, Model No. 7.1; Fig. 12, Model No. 6.32.

Third Contest (published in the June *"M.M."*):—
Fig. 1, Model No. 6.38; Fig. 2, Model No. 4.36; Fig. 3, Model No. 7.7; Fig. 4, Model No. 5.36; Fig. 5, Model No. 2.47; Fig. 6, Model No. 4.39; Fig. 7, Model No. 5.21; Fig. 8, Model No. 3.51; Fig. 9, Model No. 1.114; Fig. 10, Model No. 0.4; Fig. 11, Model No. 7.31; Fig. 12, Model No. 6.16.

Fourth Contest (published in the July *"M.M."*):—
Fig. 1, Model No. 00.96; Fig. 2, Model No. 4.7; Fig. 3, Model No. 3.51 (Fig. 3.51a); Fig. 4, Model No. 1.52; Fig. 5, Model No. 6.8; Fig. 6, Model No. 1.44; Fig. 7, Model No. 6.11; Fig. 8, Model No. 1.7; Fig. 9, Model No. 7.12; Fig. 10, Model No. 6.28 (Fig. 6.28a); Fig. 11, Model No. 0.22; Fig. 12, Model No. 4.20.

With the Secretary

Activities of New Session

Club meetings of the first Winter Session are now in full swing, and from all quarters come reports that show the existence of greater activity and interest than ever. In most clubs vigorous recruiting efforts have resulted in satisfactory increases in membership, and I am pleased to note that these campaigns have been most successful where they have taken the form of personal visitation by members, a course I have often recommended.

An equally gratifying feature is the number of new clubs that have been formed. A large proportion of these are associated with schools. Interested masters who recognise the value of a well-conducted Meccano Club act as Leaders, and as a suitable club room usually is available, new organisations of this type are in a position to apply almost immediately for affiliation. During the current session I hope to see a record increase in the number of strong clubs of this character.

Meccano Guild Library

I wish to remind Leaders and secretaries of the Meccano Guild Library, the books in which are chosen on account of their special interest for Meccano boys. They will be found of great value for Reading or Lecture nights, and may be obtained on loan for 14 days by any affiliated club, the only cost being that of return postage.

Although its primary purpose is to provide material for reading nights, the Meccano Library should prove useful in other directions, particularly in suggesting subjects for Model-building Competitions, and in helping members to build models on sound engineering lines. For instance, one of the books available is the Editor's well-known volume *"Engineering for Boys,"* and the reading from this splendid book of extracts describing types of bridges and the construction of well-known examples may lead up to a Bridge-building Competition, or to the construction by members of interesting club models of the more famous structures.

Other books in the series are *"Pioneers of Wireless"* and the *"Book of Remarkable Machinery"* also by the Editor. These will be found equally valuable in suggesting ideas for Model-building and Competitions.

Realistic Model-Building

The books in the Guild Library play an important part in a very interesting form of Model-building Evening now adopted in several clubs. The members of these form themselves into the staff of an engineering company in order to build a large-scale club model of some well-known structure. Armed with knowledge of the story of the erection of the bridge or other structure chosen, the members proceed to build their model in the same manner.

I was interested to learn from the secretary's report of the activities of one club that the members had followed this course in building a large model of the Quebec Bridge. They began by reading the account of this bridge in *"Engineering for Boys"* in order to make themselves familiar with the general features of the structure, and also with the manner in which it was erected. Plans were then drawn and the cantilevers built in true engineering style. While this was being done a small party of members assembled the suspended span. The erection of the bridge was completed by "floating" this under the gap between the cantilevers and hoisting it into position. A real river was not available and it was necessary to "float" the middle span on wheels! Except for this the erection of the model was carried out in the same manner as that adopted by the engineers responsible for the famous bridge.

It will be found that the introduction of similar touches of realism adds greatly to the interest of a Model-building Evening. There should be no difficulty in selecting suitable subjects from the books of the Meccano Guild Library and from the pages of the *"M.M.,"* and I should like to hear of more clubs making use of original methods of this kind.

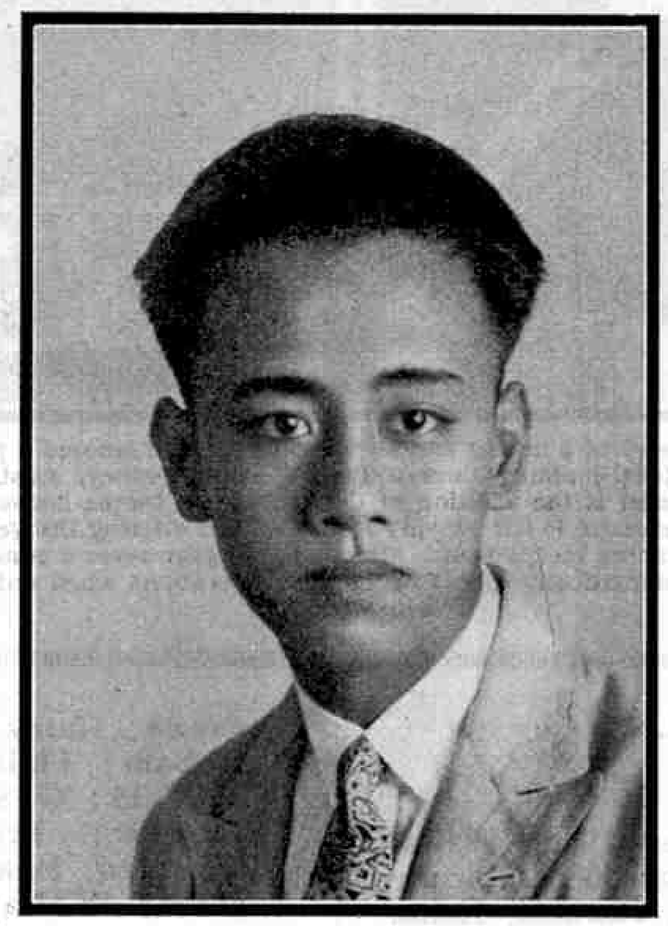
* * * *

On the opposite page will be found a number of interesting reports from clubs not yet affiliated, and I hope to hear with greater regularity from the secretaries of others.

It will be noticed that more than one of these clubs has now reached the stage of applying for affiliation. I am convinced that many clubs would become eligible for affiliation more quickly if they took advantage of the *"Club Notes"* page to advertise their existence. The *"M.M."* is read by thousands of Meccano boys who do not yet belong to any club, and also by their fathers and other grown-up people, some of whom probably would be willing to act as Leaders of clubs, while others who are unable to spare time to help in this manner no doubt would be pleased to have opportunities of supporting clubs in the splendid work they are doing.

Meccano Club Secretaries

No. 18. Mr. Tan Hock Chuan



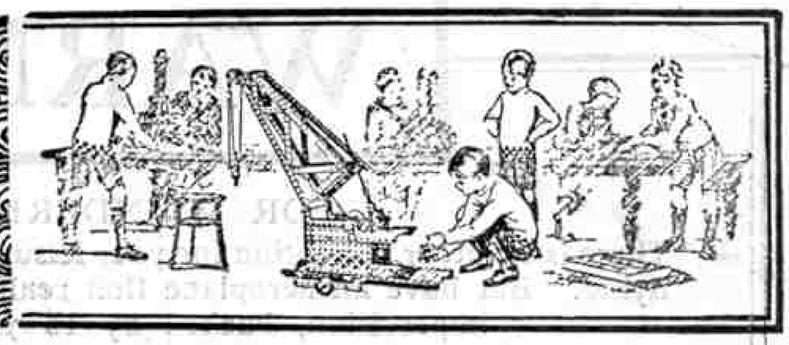
Mr. Tan Hock Chuan has been Secretary of the Singapore Chinese M.C. for more than a year. He took up the position when the former secretary left to pursue his studies in England and has ably assisted his Leader in maintaining the excellent position already attained by the club

Proposed Clubs

Attempts are being made to form Meccano Clubs in the following places and boys interested should communicate with the promoters whose names and addresses are given below:—

PORTHCAWL—A. Morgan, "Fferlys," Blundel Avenue, Porthcawl.
ROCHDALE—Eric Waugh, 9, Freetrade Street, Rochdale.
SWANSEA—A. Temlett, Wiliscombe, Haslemere Road, Sketty.
WELLINGTON—W. A. Stone, 14, North Street, Wellington, Somerset.
BIRMINGHAM—J. B. Doble, 51, Southam Road, Hall Green.
DOVER—S. Teasdale, 21, East Cliff.
DUNFERMLINE—A. Clark, Waggon Road, Crossford.
GLOUCESTER—R. Williams, 141, Southgate Street.
HEATON MERSEY—D. W. Pilling, 414, Didsbury Road.

CLUB NOTES



Ruthin School M.C.—Has commenced its winter programme with Model-building Evenings and Debates. Plays also are being rehearsed, and interesting Lectures have been arranged. Ten-minute Lectures have taken an interesting form, each member giving a short talk on his favourite hobby when his name is drawn from a hat. A few minutes are always allowed for preparation. Club roll: 21. *Secretary*: J. R. Thorougood, Ruthin School, Ruthin.

Great Baddow M.C.—Members are preparing for Visitors' Night. Two sketches, "*The Old Geyser*" and "*Dick Whittington and his Cat*" are being rehearsed and large club models constructed. Most of these models are Aeroplanes, and a special display of them is to be made. Receipts on Visitors' Night will be devoted to repair of the club-room. Club roll: 39. *Secretary*: Miss D. K. French, High Street, Great Baddow.

Belvedere M.C.—Has now been affiliated to the Guild. Model-building Evenings, Railway Nights, and Games Nights have been held, and a Lecture on "*Electricity*" was given by Mr. Hurst, of Erith Technical College. Excursions have been made to Epping Forest and other places of interest in the country. A successful Concert has been held and at one meeting Motor Cars built by members were tested for speed and endurance. Club roll: 24. *Secretary*: J. A. Hancock, 2, The Yews, Bedmell Rd., Belvedere, Kent.

Stockton M.C.—On their Annual Outing members visited Redcar and spent a pleasant day in games and rambles along the beach. The Winter Session began earlier than usual this year in order to advance preparations for the next Exhibition, for which members are now busily preparing models. Mr. J. A. Howe, who has been Leader for 4½ years, has been compelled to resign owing to business reasons, and has been elected Vice-President. He has been succeeded by Mr. N. Middleton, who has acted as secretary of the club since its foundation. Club roll: 54. Leader: Mr. N. Middleton, 14, Victoria Avenue, Norton Road, Stockton-on-Tees.

Selwood House School (Falmouth) M.C.—Picnics on the beach were held during the Summer, one on breaking-up day being particularly enjoyable. Gramophone Evening was a great success, and had to be cut short because members brought more records than could be played. Club roll: 12. *Secretary*: F. G. A. Ashby, Selwood House School, Falmouth.

Newcastle-on-Tyne M.C.—Has now secured a club-room, a roomy apartment with use of office appliances having been placed at its disposal by a local gentleman, who has been elected President. The Building Fund is to be continued in order to provide a permanent home for the club. A special Recruiting Campaign was held at the beginning of the session, and a Drum and Fife Band was organised to assist in this. At the next Exhibition competitions for Meccano Boys not already members have been arranged, and entries are invited. Club roll: 32. *Secretary*: K. Mark, 445, Chillingham Road, Heaton, Newcastle-on-Tyne.

Victoria (Glasgow) M.C.—Two joint meetings with Morison Memorial M.C. have been held. The first was a visit to Glasgow Corporation Sewage Works, and the second was the Annual Inter-club Sports, held on the Y.M.C.A. grounds. The present is the club's eighth Winter Session, and efforts are being made to arrange a record programme. Club roll: 56. *Secretary*: R. Hannah, 52, Thornwood Ave., Partick, Glasgow, W.1.

South Shields M.C.—At the opening meeting of the Winter Session Mr. J. Guy gave a Lecture on "*X-Rays*," and members were very greatly interested in the practical demonstrations that accompanied it. A Hornby Train Section for the Juniors has been established. More members are urgently required, and those intending to join should apply to the Leader or Secretary. Club roll: 12. *Secretary*: Mr. A. J. Robson, Albion House, South Shields.

Fulstow Junior M.C.—The Football team started well with a victory over Fulstow School, but unfortunately lost the return match. A club model of the Meccanograph is being constructed for use at Exhibitions and Visitors' Night. A Motor Show Night has been arranged and members are constructing original models of cars for entry in the Competition. Club roll: 13. *Secretary*: L. W. Doe, The Stores, Fulstow, North Thoresby, S.O. Lincs.

King Edward VI School (Birmingham) M.C.—Has celebrated its fourth birthday, which found it in a stronger position than ever. Two Lantern Lectures were given, one on the "*Birmingham Gas Works*" and the other on the "*Elan Valley Water Scheme.*" A series of lectures on "*Electricity applied to Meccano*" also has been given, in addition to a number of papers by members. Many fine models have been made by members, including model Racing Cars incorporating the Meccano Clockwork Motor. These were tried over a straight course of 22 yards, the winning car travelling at a little more than eight miles per hour. Entrants in a novel Competition are asked to make a Water Clock. This was suggested after a talk on "*Ancient Methods of Time Measurement.*" Club roll: 98. *Secretary*: A. L. Noke, 90, Trinity Road, Birchfield, Birmingham.

Hull Grammar School M.C.—Celebrated "Hull Civic Week" by a small Exhibition of Meccano Models. Meccano and Hornby Train Nights have been held alternately. An innovation on Model-building Evenings is the reading by each member of a descriptive paper on a model built by himself. In this the construction and use of a prototype of the model also are explained. Club roll: 34. *Secretary*: H. King, 37, Louis Street, Springbank, Hull.

Australia

Hobart (Tasmania) M.C.—Has celebrated its second birthday by a special meeting at which prizes were presented and new officials elected. A pocket notebook was presented to the retiring Leader, Mr. F. Wells. A new Leader has been secured in Mr. G. G. Green, who has presented a Cup, to be known as "The Green Trophy," which will be awarded annually to the member who obtains the highest marks for his section. Rifle Range Shooting has been introduced. Members have constructed a splendid working model of a Shooting Gallery, in which a Meccano Naval Gun is used. It was on show at the Annual Exhibition and Concert. Other models included the Novel Electric Game described in the February "*M.M.*," and a play was presented by members. Receipts totalled £6. Club roll: 21. *Secretary*: F. Downie, 50, Letitia Street, North Hobart, Tasmania.

Our photograph shows a group of members of the Dunoon and district M.C. Since its affiliation in November 1928, this club has made splendid progress under the Leadership of Mr. R. Muir Lang, who is seated in the centre of the group. Model-building is the chief feature of the work of the club

New Zealand

Kaiapoi (Canterbury) M.C.—Has now been affiliated to the Meccano Guild, and is making good progress. Excellent outdoor meetings have been held, including Paperchases, and preparations are now being made for Concerts, by means of which it is hoped to raise funds for the purchase of more Meccano parts. On Model-building Evenings members are at work on entries for a Model-building Competition conducted by a Meccano dealer in Christchurch. Club roll: 35. *Secretary*: L. Allison, North Road, Kaiapoi, Canterbury.

Clubs Not Yet Affiliated

Aberdeen M.C.—This newly-formed club has already secured a Leader, and is looking forward to affiliation. A general meeting was held in order to decide on a programme. Members are very enthusiastic, but more are required. Applications to join should be made to the Leader: Mr. J. N. Piper, 118, Union Street, Aberdeen.

Brighton M.C.—Is making good progress, but is still without a Leader. The secretary would be glad to hear from a gentleman who is willing to take this position. Meetings are well attended. Most of them are devoted to Model-building, but Games and Excursions also have been arranged. *Secretary*: D. Read, 221, Queens Park Road, Brighton.

Churcher's College (Petersfield) M.C.—A very vigorous recruiting campaign has doubled the membership, and a larger clubroom is now required. The club has an excellent Library, 50 books having been added recently. Fretwork Evenings are held, but Meccano Model-building is the chief recreation. The stock of parts is increasing steadily, and many splendid club models have been constructed. A Leader is urgently required. *Secretary*: G. H. Shaw, Churcher's College, Petersfield.

King's Lynn M.C.—This new organisation has made excellent progress, Mr. I. J. Thatcher, General Manager of the Kings Lynn Docks & Railway Co. has accepted Leadership, and by kind permission of the Chairman, meetings are held in a room in the offices of the Company. Members take a great interest in railway operation, and have constructed a shelf round the clubroom on which to lay an extensive Hornby track. *Secretary*: J. P. Smith, Carlton Lodge, The Chase, King's Lynn.

Oxford Central Boys' School M.C.—Although only recently formed this club is very vigorous and active. Members have constructed a large club model of a Giant Hammerhead Crane, which was exhibited throughout the School. Messrs. F. Biggers and G. Hall, two Masters at the School are acting as Leaders and affiliation has been applied for. *Secretary*: P. C. Bosworth, 72, Walton Street, Oxford.

Sunderland M.C.—Members visited the "*North East Coast Exhibition*" at Newcastle, where they were specially interested in the models of ships and locomotives. Mr. Willis, the Leader, gave clear explanations of everything seen. Members also were interested in the new Tyne Bridge crossed on the journey. The club meets in a schoolroom, but more convenient accommodation is being looked for. *Secretary*: T. Crute, 28, Ridley Street, Southwick, Sunderland.

New Zealand

Waikaka Valley M.C.—Is at present without a clubroom, meetings being held in the houses of members. Model-building is the chief interest, several versions of the Motor Chassis having been built. Games Nights are held regularly. A Social has been held and several interesting Visits have been paid to Works and Factories in the district. *Secretary*: W. Smith, Gore Waikaka Road, Southland, New Zealand.

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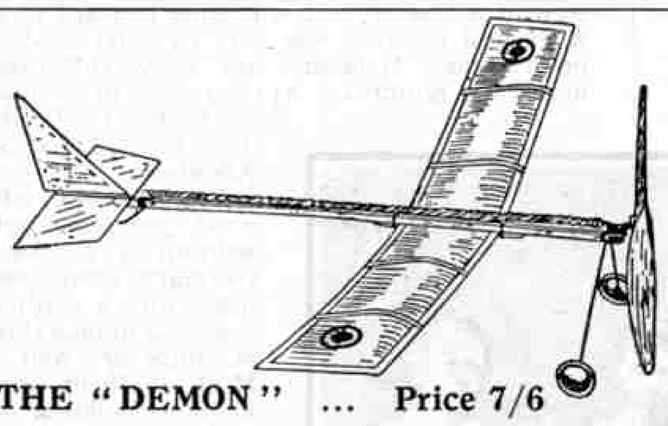
Flight Lieutenant. — **Flying Officer.** **Flying Officer.**

Flight Lieutenant. — **Flying Officer.** **Flying Officer.**

Flight Lieutenant. — **Flying Officer.** **Flying Officer.**

Squadron Leader flies streamers in School colours from Wing Tips and Fin. Flight Lieutenants fly streamers from Fin only.

Any information regarding the forming of your squadron will be gladly given on application. Also our technical expert will be pleased to reply to any questions on the flying of your Warneford Model.



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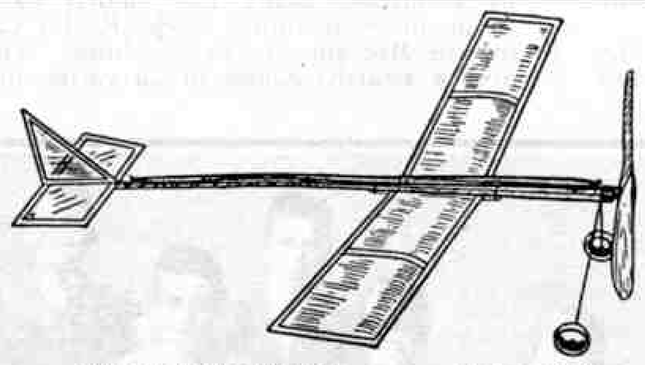

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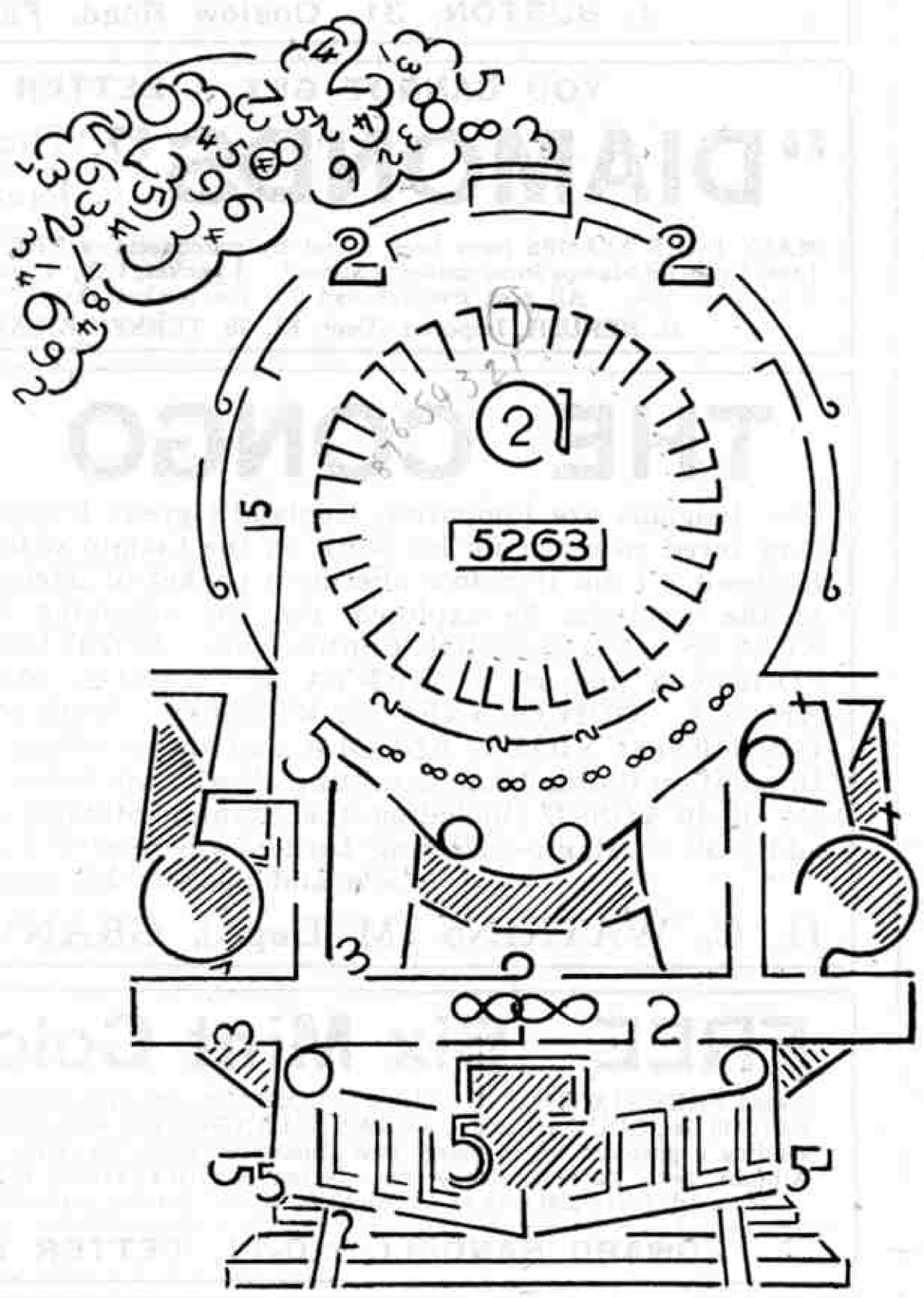
Competition Page

Can You Count?

Some curious propositions to study and solve have been put to our readers on this page from time to time, but we venture to believe that there has been nothing quite so teasing as this month's competition.

Our drawing apparently depicts a front view of a giant locomotive, but closer examination shows that every single line in the picture is a figure! Readers are invited to test their skill in addition by ascertaining the sum total of the figures employed. In this contest there are no annoying tricks to trap the unwary. The test is purely a matter of skill in locating every numeral and adding it to its fellows. Every one of the figures is plainly in sight.

It should be explained that each figure is to be counted separately; there are no combinations of two or more figures to make numbers such as 12 or 123. Only the figures 1 to 9 are employed. Some, of course, are upside down, and the sixes and nines must be scrutinised carefully in consequence. It will facilitate identification if it is explained that the curl of the nines is *closed*, and joins up to the stem of the figure; that of the sixes is *open*.



To ensure that no one shall know the exact total of the figures before the closing date, the Editor and the judges each erased a figure from the sketch before it was reproduced. No one knows which figure the others took out; the answers to that question are in sealed envelopes in the Editor's desk. At the close of the contest these envelopes will be opened and the total of the figures disclosed will be deducted from the original total in the drawing, to give the correct figure.

Prizes of Meccano or Hornby Train goods (to be chosen from our catalogues by the winners themselves) to the value of £1-1s., 15/–, 10/6 and 5/– respectively will be awarded to the senders of the four nearest estimates, in order of merit. In addition there will be a number of consolation prizes for those whose entries come next in order. In the event of a tie for any of the prizes, preference will be given to the neatest of the tying entries.

No competitor may submit more than one entry.

Competitors should write their solutions clearly on a post card, and give their full name and address. The post card should be addressed to "Loco Figures, Meccano Magazine, Binns Road, Old Swan, Liverpool," and must be sent to reach this office not later than 30th November. Overseas closing date, 28th February, 1930.

A New Eye-Teaser

The Aeroplane of the Future

A year or so ago we held a drawing contest to discover our reader's ideas on "Locomotive Design of the Future." It proved one of the most popular and interesting competitions we have ever organised. This month we are asking our readers to apply their prophetic powers to the sphere of aviation.

Despite the remarkable increase in aeroplane speeds attained in the recent race for the Schneider Trophy, there seems excellent reason to suggest that finality is being approached for the present type of machine. That is not to say that very much greater speeds will not be attained. Unquestionably, they will. The time will come when 1,000 m.p.h. will be commonplace with passenger-carrying machines, and when such machines will be able to fly, float on water, run on land, hover like birds in the air, and take (*Continued in third column*)

June Crossword Puzzle

The Overseas section of this competition having closed, we are able to publish the solution.

R	E	S	T	■	A	S	H	P	I	T	■	T	O	S	S
A	R	T	I	C	L	E	■	■	N	A	T	U	R	A	L
C	R	A	N	■	G	R	A	S	S	Y	■	N	A	V	E
E	A	R	■	T	■	E	T	N	A	■	T	■	L	A	D
■	T	■	P	R	O	N	O	U	N	C	E	D	■	G	■
S	I	T	■	A	■	E	L	B	E	■	S	■	T	E	A
O	C	E	A	N	S	■	L	S	■	S	T	E	E	D	S
L	■	A	S	S	E	S	■	■	F	L	A	M	E	■	S
A	■	S	P	I	T	E	■	■	R	E	M	I	T	■	E
C	R	E	S	T	S	■	C	R	■	W	E	T	H	E	R
E	E	R	■	I	■	F	E	E	T	■	N	■	E	A	T
■	V	■	S	O	L	I	D	A	R	I	T	Y	■	S	■
W	E	T	■	N	■	N	A	V	Y	■	S	■	A	T	E
I	R	O	N	■	C	A	R	E	S	S	■	F	L	E	A
R	E	M	O	V	A	L	■	■	T	O	I	L	E	R	S
E	D	E	N	■	R	E	L	I	S	H	■	S	E	N	T

(*Continued from first column*)

off and alight almost vertically.

Clearly, there will be some striking changes in design, but it will be an evolution rather than a revolution. It is our readers' view as to the future trend that we seek, when we ask them to sketch "THE AEROPLANE OF 2,000 A.D."

Entries will be divided into the usual two sections: A, for those from competitors aged 16 years and over, and B, for those below 16. Prizes of Meccano products, or Artist's materials, as desired, to the value of £1/1/– and 10/6 respectively, will be awarded to the first two entries, in order of merit, in each section.

Any competitor may submit more than one entry, but each must bear his name, age and address on the back. Entries must be addressed to "29th Drawing Contest, Meccano Magazine, Binns Road, Liverpool." Closing dates: Home, 30th November; Overseas, 28th February, 1930.

SG

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40	,, ...	9d.	20	Poland ...	3d.
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50	,, ...	1/4	30	,, ...	5d.
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30	,, ...	4d.	40	,, ...	7d.
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50	,, ...	8d.	50	,, ...	9d.
60	,, ...	1/–	55	,, ...	10d.
70	,, ...	2/–	60	,, ...	11d.
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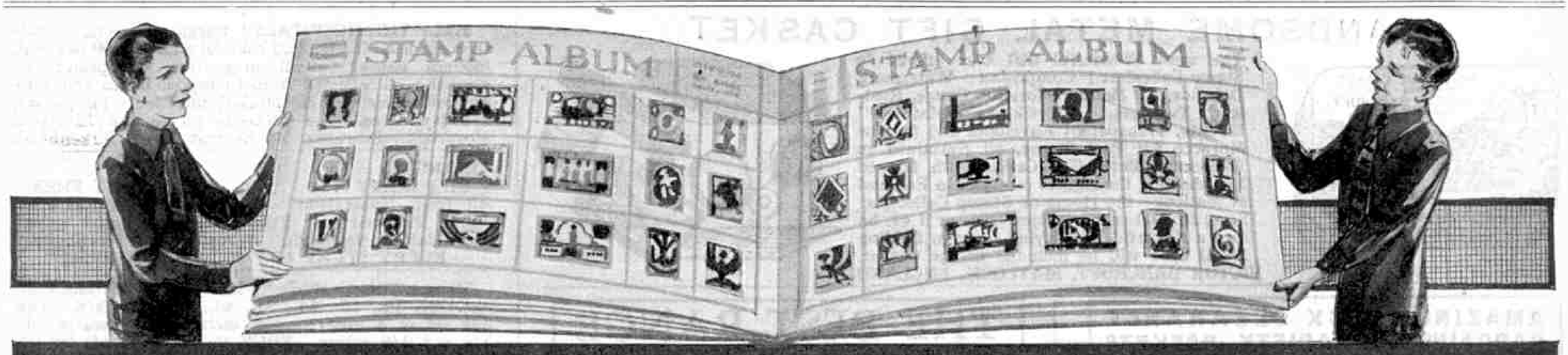

STAMP COLLECTING

SOME FAMOUS CATHEDRALS

IN our stamp article for May last we dealt with some of the most interesting pieces of architecture that survive—principally in ruins—from the pre-Christian era. This month we are to deal with the great cathedrals that were the outcome of the Roman architectural influence of the early Christian period. This period, right up to 1000 A.D., when the Norman influence began to be felt, was remarkable for the almost complete absence of striking buildings other than ecclesiastical. Probably there is an explanation in the fact that the life of the community in those days was centred so largely around the Church that the building energy of the times was devoted almost exclusively to religious purposes.

Many of the great cathedrals that were conceived in this period and in the early Middle Ages are strikingly imposing, and many are beautiful, even to the eye of the keenest architectural critic. Some have made wonderfully effective stamp designs, and there springs to mind immediately Belgium's Charity issue of December, 1928. This was in aid of a national Anti-Tuberculosis Fund, each of the stamps being sold at a premium. The five lower values each depicted one of Belgium's cathedrals: Mons (5c.+5c.); Tournai (25c.+15c.); Malines (35c.+10c.); Ghent (60c.+15c); and Ste. Gudule's Cathedral, Brussels (fcs. 1.75+25c.). The sixth stamp (5f.+5f.) shows the beautiful Louvain Library that was completely destroyed during the recent European War. We illustrate the cathedrals of Malines and Brussels, which are probably the two most famous.

The cathedral of St. Rombaut, Malines, to give it its full name, is the Metropolitan church of Belgium. It dates back to the latter part of the 12th century, although the present structure is really a restoration of the old, which was seriously damaged by fire in 1450. The great tower is the dominating feature, as the stamp plainly shows. It was the greatest tower ever projected in the Middle Ages. The original intention was to carry it up to 650 ft., but for some undisclosed reason work was suspended in 1853, when a height of 350 ft. had been attained.

Ste. Gudule's, Brussels, is chiefly notable for the great twin steeples at the west front, a feature entirely at variance with the usual practice in Belgium. It is the second church to occupy the site, and bears the name of a Belgian nun, Ste. Gudule, who died in the convent of St. Nivelle in 712. In her honour a great church was erected and completed in 1047. Later it was decided to build a grander edifice and work on the present cathedral was commenced in 1226. It was not completed until nearly 300 years had elapsed, however, the towers actually being finished in 1518. Subsequently, in 1679, the beautiful domed chapel of Ste. Madeleine was added.

The windows of Ste. Gudule's are world-famous and include six, in the clerestory of the choir, that are reputed to be the finest and purest specimens of early Belgian tracery in existence.

A particularly interesting feature of this Belgian issue is that each stamp design has been framed in a setting of arches and columns appropriate to the architectural order of the principal subject.

A very interesting example of twin steeples is to be found on Germany's 10,000 mark 1923 issue, which shows Cologne Cathedral, a very fine example of Gothic architecture. The present building is the third cathedral to occupy the same site, the earliest being completed about 825. It was commenced in 1248, but progress was so slow that it was not until 1880 that it was finally completed. The plan is cruciform, 480 ft. in length and 282 ft. in breadth, while the spires are 571 ft. in height.

A cathedral that holds special interest for English folk is the great Basilica of Rome, St. Peter's, illustrated on the 60c. denomination of the Italian Holy Year issue of 1924. Sir Christopher Wren, the great British architect, is said to have based his design for our own St. Paul's Cathedral in London on St. Peter's, and in many respects there is a close likeness. St. Peter's, covering a total area of some five acres, is much the larger building, however, although the dignity of its bold proportions has been lost by the puny conception of the general exterior design. St. Peter's real claim to architectural greatness, in fact, arises solely from the dome, the highest in the world, its pinnacle being 432 ft. above pavement level, while the cupola is 139 ft. in diameter. It was the work of the great architect Bramante, and if his original plans for the whole structure had been carried out St. Peter's probably would have been the greatest piece of ecclesiastical architecture in the world. After Bramante's death in 1514, most of his ideas were scrapped.

The most interesting stamp of our "Cathedral" collection, although the subject is not quite within the strict category, is the 10h. issue from the Bosnia and Herzegovina set that appeared on 28th June, 1917, the third anniversary of the assassination of the Archduke Ferdinand at Sarajevo, the incident that was the nominal cause of the European War. This issue contained three stamps, all of which were sold at 2h. premium to provide funds for the building of a memorial church at Sarajevo, a striking picture of the proposed church appearing on the 10h. stamp. The two remaining issues of this series show portraits of the Archduke Ferdinand (15h.) and on the 40h. the Archduke and Archduchess together.

(*Continued on page 897*)

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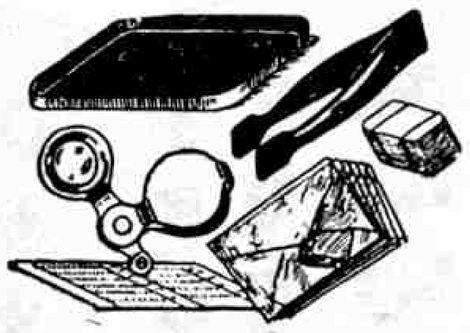

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FREE. 150 unsorted Stamps and first 3d. off approval Sheet FREE to all sending 2d. requesting our approvals. We have large selections from ¼d. each upwards. Usual discount.—WAY, 17, High Street, Epsom.

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STAMPS on and off paper direct from banks, etc., in lots of **1/-, 2/6, 5/-, 10/-,** latter containing 1 fine stamp, catalogued 18/6. Also 1d. and ½d. approvals.
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I WILL SEND ON APPROVAL ONE THOUSAND DIFF. STAMPS
from which you may select any **100 FOR 3/-.** More advanced Collectors are requested to ask for my selections of separately priced stamps.
Special Terms to all my old customers.
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Have you seen them? Record approvals of Foreign & Colonial Stamps. Huge discount of **8d.** in 1/- or for all net purchases of 2/6 and upwards, **9d.** in 1/- dis. These selections are sent out in approval books and **contain** superior stamps, far better than the trash **that is** often sent out on approval sheets and only **6d.** in 1/- discount showed. This is **why No Free Gift (often** of no value) is given. The **full value** is in the approvals.
Record Stamp Co., 23, Canning Road, East Croydon.

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If after receiving all **Free Gifts** you can, you decide on Collecting seriously, then get in touch with me. I offer you the choice of a stock gathered during fifty years at reasonable prices. Special selections of any country or group and out-of-the-way varieties sent on approval. Some **JUBILEE BARGAINS**:—Gold Coast K.G. 2/-, 5/- & 10/-, fiscally used 1/- the 3, 12 different other Gold Coast 1/-, 12 Capes 1/-, 4 Perak 1/-, 6 Sarawak 9d, 5 Tibet 1/-, 12 Cochin 9d, 7 Iceland 6d, 12 Ceylon 6d, 5 Tanganyika 4d, 12 Kenya 9d, 12 Orange River 1/6, 12 Transvaal 6d, 10 Luxemburg 4d, 10 Bosnia 4d, 2 Falklands 3d, 12 Trinidad 10d. Common stamps by weight containing many rare, a bit damaged 1/3 per ½lb. Finest stamp mounts 5d per 1,000. Add postage.
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Lists of other Sets, Packets and Accessories free.
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MECCANO WRITING PADS

These Writing Pads are just the thing to use when writing to your friends, for the special notepaper shows at once that you are a Meccano boy.

The pads are supplied in two sizes, each consisting of 50 printed sheets of tinted bank paper with cover. Prices—Large, 1/- each (post free); Small, 6d. each (post free), from Meccano Ltd., Old Swan, Liverpool.

1,000 PACKET A WONDERFUL OFFER

of stamp bargains. Price **4½d.,** postage **2½d.** extra, abroad collecting friends. *Ask for my famous approvals.*

The "**1,000** Packet" contains **500** excellently assorted Stamps, a COMPLETE SHEET of **100** UNUSED (very useful for exchange purposes); a neat **12-page** booklet for holding duplicates; **25** British Colonials, usually sold at ½d. to 1d. each, including new and obsolete issues; **375** Magic "Strip" Mounts, and my price list 6d. extra. In addition, free sets will be sent to those who send name of stamp
H. C. WATKINS, M. Dept., Granville Road, BARNET.

Stamp Gossip

The 1930 Catalogues

Once upon a time the arrival of the new season's catalogues was regarded as the signal that the stamp collector might bring out his albums, perforation gauges and benzine bottles, from their summer hiding places, pick up the threads of his neglected hobby, and rejoice. Nowadays the stamp collecting fever maintains its grip throughout the year, and albums remain handy throughout the summer months. One thing alone remains unchanged and unchangeable—the collector's eager interest in a new catalogue.

The Gibbons' catalogue grows stouter with age—this year the Whole World volume contains nearly 2,000 pages—and one trembles to visualise its monumental size 100 years hence if the present spate of new issues continues. Presented in a gold-lettered blue binding for 1930, this great catalogue is indispensable to the even moderately keen collector. Every variety of importance—in shade, watermark, perforation or overprint—is listed and illustrated, so that identification and classification of any stamp is readily achieved.

The differential pricing system of indicating the maximum and minimum prices for stamps whose condition varies considerably, is maintained, although for the present, at least, it is not to be extended beyond the British Colonial section. This system of pricing has aroused keen controversy but, for ourselves, we consider its introduction justified by the encouragement, guidance and protection it affords to the young collector. We have no quarrel with the collector who desires nothing but pristine specimens in his collection and pays for the privilege, but when his keenness becomes impatient with the idea of recognising less perfect specimens, it is time to call a halt to re-

A first flight cover from the Galway-London air mail experiment mentioned on this page

adjust his perspective. The poor specimen may be an "ugly duckling" but it is, probably, some young collector's "swan." It has done its job and is entitled to recognition, though on a humbler scale.

Another interesting innovation in Gibbons' this year is the separate pricing of postally used and "cancelled to order" Labuan and North Borneo issues.

The Whitfield King catalogue makes no pretension to cover the ground in so elaborately detailed a manner as its older brother, Gibbons', and although necessarily increased in size in comparison with previous issues, it still remains a handy pocket volume, despite its 900 pages. In our view, it is the ideal catalogue for the collector of limited knowledge, who, as it were, has still to find his niche in the hobby. While all the really important varieties are listed, the catalogue ignores much of the detail, so essential to the advanced collector, that is apt to fog the beginner's mind. The purpose of general classification of stamps is made quite simple by the use of 5,900 quarter-size illustrations.

From the preface we glean the very interesting note that actually 1,496 new stamps have been issued in the past 12 months, making a total of 50,203 to date. Of these, 15,308 come from Europe, 9,352 from Asia, 11,594 from Africa, 8,267 from America, 3,120 from the West Indies and 2,562 from Oceania.

Further details of both the Gibbons' and Whitfield King catalogues will be found in our advertisement columns.

Help The Hospitals !

Under this title, on an advertising page, appears an offer that will appeal to many of our readers: packets of unsorted foreign stamps, straight from Liverpool shipping offices, banks and other business houses, guaranteed 99 per cent. modern issues. An inspection of a sample packet, taken at random, revealed a surprising range of modern used stamps, including only a moderate proportion of European issues. The number of packets available, we understand, is very limited.

The advertiser is disposing of these stamps on behalf of the Liverpool Hospitals.

American Mail Speed-up

An interesting experiment in expediting the delivery of mails from America to London was carried out on Monday, 26th August, when mails from the German liner "*Karlsruhe*" were landed at Galway on the west coast of Ireland by motor launch and rushed to London by aeroplane. The time occupied on the flight was four hours, and a saving of 36 hours was effected over the scheduled times for steamer and train.

The mail consisted of 5,000 letters weighing a total of 100 lb., and was delivered in London at 11.30 a.m., within five hours of the arrival of the steamer at Galway. Later in the day an aeroplane left Croydon with mail for a steamer outward bound from Galway.

By the courtesy of Mr. C. F. Bourke, we are able to publish here a photograph of a first flight cover from this experiment, bearing the official cachet. Particularly interesting are the two blue air mail labels, inscribed in Erse and Roman characters.

We would like to be able to publish more of these interesting and historic souvenirs, for we know from correspondence that many of our readers are very keenly interested in the Air Mail side of stamp collecting. The difficulty is that the scope for developments in Great Britain is insufficiently big to maintain a steady flow of interest, and it is to Overseas and Continental countries that we are compelled to look for assistance.

Our readers abroad in all parts of the world can help us by sending specimen covers from any new service inaugurated in their country. We will gladly refund any expenses involved and acknowledge the assistance in the magazine itself.

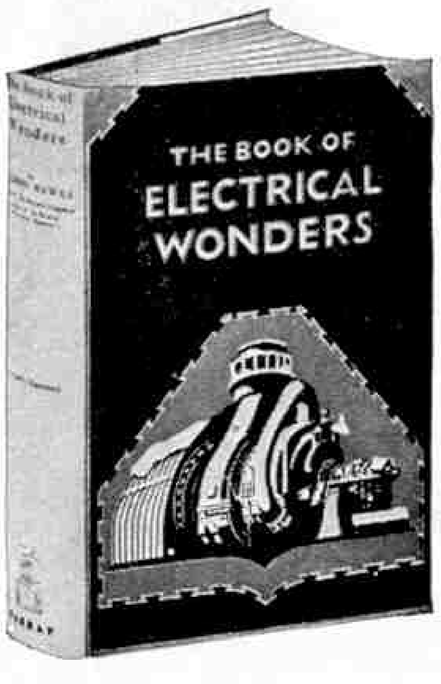
If desired the cover will be returned, but where possible, in such circumstances, we suggest that two covers be sent, one for Editorial use and the other for return.

Stamp Collecting—(*Continued from page 895*)

In strange contrast to this "rebuilding" set is the Bulgarian 50st. issue of 1926 in commemoration of 140 people who were killed in the Cathedral of Sveta Nedelia in Sofia on 16th April, 1925. A great congregation had gathered to attend the funeral of the Government Deputy, General Georghieff, who had been assassinated three days previously. Suddenly, during the service, there was a terrific crash as a time bomb exploded at the foot of one of the principal columns. The roof and the greater part of the building was destroyed, and among the victims were prominent members of the Government, politicians and State officials. To preserve their memory the special stamp illustrated here was issued.

We take this opportunity of making acknowledgment to Stanley Gibbons Ltd., for their courtesy in loaning the stamps from which the illustrations used with this article have been prepared.

The Editor's New Book



The Book of Electrical Wonders

By ELLISON HAWKS

Profusely illustrated 7/6 net

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The Book of Remarkable Machinery

Obtainable from all booksellers

Write for special illustrated list of "Harrap Books for Boys" to

GEORGE G. HARRAP & CO. LTD.
39, Parker Street, London, WC. 2.

come on you chaps!

Look at this Fairycycle! With balloon pneumatic tyres; powerful brakes and glittering handlebars—what a bike! What a proud machine to ride! Fancy going out to tea on it! Fancy turning up at school on it! Fancy the other chaps crowding round! Yes, you must wangle a Fairycycle.

Every possible detail of equipment on her. Dunlop balloon tyres for solid comfort, tangent spoke wheels with glittering plated rims; bell, pump, tool bag with real tools; stand, so that she stays upright when not in use, and carrier for the mater's parcels. Moreover, any Fairycycle can be fitted with a flat plate between the saddle and the handlebars showing a realistically painted motor cycle engine! Yes, the No. 8 Fairycycle is a machine in a thousand and is so strongly built that when you are big enough to hand it on to a small brother or sister it will still be well worth handing on.

L. BROS. Ltd. LONDON BROS ENGLAND

FAIRYCYCLE

Fairycycles are made in the following sizes at the prices stated:

Model A.—Well finished in black cycle enamel, ball-bearing pedals and plated handlebars. Dunlop saddle, 12″ tangent spoke wheels, $\frac{5}{8}$″ rubber cushion tyres - **29/6**

Model Ax.—Like Model A, but larger size, with 14″ wheels and $\frac{5}{8}$″ rubber cushion tyres - **33/–**

Model B. — Very suitable for young children, being light and easy to ride. Has 12″ tangent spoke wheels with $\frac{7}{8}$″ rubber tyres. Complete with chain-guard, reflector, stand and carrier - - - - **39/6**

Model Bx.—As model B but larger size with 14″ wheels and $\frac{7}{8}$″ rubber cushion tyres - **42/–**

Model C.—Raised pattern plated handlebars, has chain guard, stand, carrier, reflector and bell. Cycle pattern rim brake, 12″ tangent spoke wheels, adjustable ball-bearing hubs, 1″ imitation pneumatic tyres - **49/6**

Model Cx.—As model C but larger size with 14″ wheels - **52/6**

Model Px.—As model Cx but with 14″ × $1\frac{3}{8}$″ Dunlop "Kempshall" pneumatic tyres - **55/–**

Model D.—Cycle type brakes, raised pattern plated handlebars, 2-coil spring saddle, etc. $\frac{1}{2}$″ × $\frac{1}{8}$″ roller chain, adjustable ball bearings throughout. 12″ tangent spoke wheels with 1″ imitation pneumatic tyres, complete with chain-guard, stand and carrier, reflector and bell - **59/6**

Model 6.—Strongly built for children up to 9 or 10 years old. 16″ tangent spoke wheels fitted 1″ imitation pneumatic tyres, adjustable ball-bearings throughout, cycle pattern rim brake. Imitation pneumatic tyres, 3-coil spring saddle, tool bag, bell, etc. - - - **70/–**

Model 8.—The "Rolls-Royce" of Fairycycles, raised pattern plated handlebars, $2\frac{1}{4}$″ buttress tread Dunlop balloon tyres. Plated ball-bearing pedals, tool bag, carrier, stand, bell, reflector and pump, etc. - - **87/6**

All these models with the exception of models A and Ax are finished in black or blue, with gold lines. Fairycycles can be obtained at all good toy shops, or write for illustrated leaflet.

FAIRYCYCLE ASSOCIATION
Membership free to owners of genuine Fairycycles and badge attached to every machine. Simply fill up the form when you buy your Fairycycle, post it to Lines and you will then become a member. This is the badge of the Fairycycle Association.

LINES BROS. LTD., MORDEN ROAD, MERTON, LONDON, S.W.19

Fireside Fun

WORK FOR A BUILDER

The road hog was late home for dinner one evening and his wife asked him the reason.

"Oh," he said carelessly, "on the way home I ran into a garage."

"You are needing repairs then?" queried his wife.

"Car's all right," he replied; "but you should see the garage."

* * * *

"Everything bad, from conduct to chemistry," said the Father, reading his son's report. "It's disgraceful."

"Yes, Dad, you ought to bring an action for libel against the school."

* * * *

A lunatic was wandering in the asylum grounds wheeling a barrow upside-down. Someone seeing him said: "You should wheel that the other way round."

"Hush!" said the lunatic anxiously. "If I did they'd put bricks in it!"

* * * *

The bus was crossing Westminster Bridge. "Say, Conductor," said the American, "What do you call this stream here?"

Hastily the conductor looked over the side. "Dash it!" he said. "The radiator must have sprung a leak again!"

* * * *

Mrs. Yokel rushed into her neighbour's house in a state of panic.

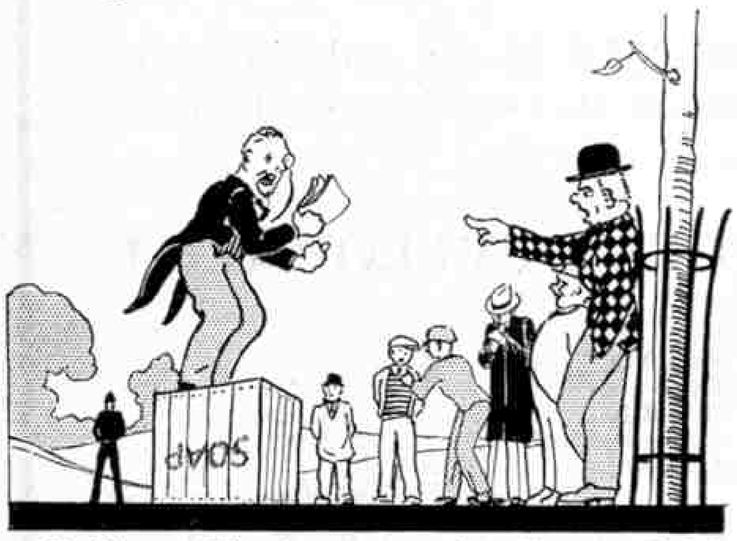
"I've had a terrible warning of approaching death," she managed to say.

"What ever do you mean?" asked her neighbour.

"Well," said Mrs. Yokel. "I bought a fountain pen a few days ago. The makers guaranteed it to last my lifetime, and it's just broken!"

* * * *

JUST WHAT HE NEEDED



Heckler: "Why do you wear that silly monocle?"
Speaker: "Because I have a weak eye."
Heckler: "Why don't you wear a glass hat?"

* * * *

The golfing novice finished his first game and handed his score card to the Secretary. "Two below bogey!" he remarked proudly.

"But," protested the official, "this is nowhere near bogey!"

The novice looked hurt. "Compare the score," he said, "with the figures on the card, and you'll see."

The Secretary looked. "Great Scott, man" he roared, "that's the length of the course in yards."

"*Tit-Bits.*"

* * * *

"There's one thing about that new clerk—he's so reliable; you always know what he's going to do next."

"And what's that?"

"Nothing!" "*Everybody's Weekly.*"

SPOILT!

A holidaymaker went fishing on the pier and, having pulled out a good-sized plaice, threw it back again.

"Wot d'yer do that for?" asked a native.

"I don't want one what's been trod on," said the man.

* * * *

Father (to boatman): "What is the charge for hiring a boat?"

Boatman: "A shilling the first hour, sir, and sixpence the second."

Young Hopeful: "Let's go the second hour, Daddy!"

* * * *

FOOLED FOR ELEVEN YEARS!

An old lady who was visiting a prison said with a cheerful smile to an elderly prisoner:

"You must smile, my man, and remember that 'stone walls do not a prison make.'"

"Then I've been fooled for eleven years," said the prisoner sadly.

* * * *

A little Cockney boy on his first visit to the country stumbled over an empty tin which he recognised as having contained condensed milk.

"Daddy," said he, "I've found a cow's nest."

* * * *

After much effort the house was built, and the foreman told his man to stay in one room while he went into another and spoke to him through the wall.

"Can you hear me, Jack?" he asked.

"Yes," replied Jack.

"Can you see me?" the foreman asked.

"No," replied the man.

"Ah," exclaimed the foreman with pride. "What a house." "*Liverpool Daily Post.*"

* * * *

OF COURSE

Inspector (to small boy): "Now, what are raised in damp climates."

Small Boy (promptly): "Umbrellas, sir."

* * * *

"Did you put that stamp on the letter I gave you?" asked mother.

"No, I didn't have to," said Mary, triumphantly. "I just slipped it in when the postman wasn't looking!"

* * * *

Teacher: "Give me a sentence using the word 'statue.'"

Abie: "Ven I came in last night, mine fader said, 'statue, Abie?'"

* * * *

"Hoy, waiter. There's a chicken in this egg!"

"Good gracious, sir, so there is! That will be three-and-six for a portion of chicken, sir!"

* * * *

A youth with a very large mouth walked into a music shop to purchase a mouth-organ. He was shown every make of mouth-organ in the shop, but still was not satisfied.

"Look here," said the assistant, "we shall have to measure you for one. Just try your mouth along this piano."

* * * *

Professor (after being fished out of the river): "The worst of it all is that I've just remembered that I can swim."

HIS FIRST IMPRESSION

Little Willie's favourite uncle had arrived.

"Hallo, old chap!" said Uncle. "And how do you like school?"

"I like it best closed," was Willie's reply.

* * * *

Beggar: "Could you give a poor cripple enough for a cup of coffee and a sandwich?"

Kind Old Lady: "Why, my poor man, how are you crippled."

Beggar: "Financially, lady."

* * * *

"Have you anything to say, prisoner, before I pass sentence?" asked the judge.

"No, Your Honour—except that it takes very little to please me." "*Boston Transcript.*"

* * * *

An old farmer was picked up on the highway and given a lift by a reckless driver. As he got out he said: "Thank you very much for both rides."

"What do you mean—both rides?" asked the benefactor

"You have given me my first and my last," was the answer. "*Stock and Dairy Farmer.*"

* * * *

"Mother, may I go over and play with Tommy Wilks?"

"No, Tommy has gone away with his father and mother. Why not go and play with little Peter?"

"Well, I played with Peter yesterday and I don't think he'll be well enough yet."

* * * *

The poor artist had come up from the country with a drawing, but the editor was unsympathetic. "Sorry, we can't use it," he said.

"What?" exclaimed the artist. "Can't use it? Do you know I've carried this joke forty miles for you to see?"

"Well, all I can say is," said the editor, "you've carried the joke too far!"

* * * *

Gentleman (watching small boy fishing): "What bait are you using, my boy?"

Boy: "A bone, sir."

Gentleman: "A bone! What sort of fish do you think you will catch with that?"

Boy: "Dogfish, sir!"

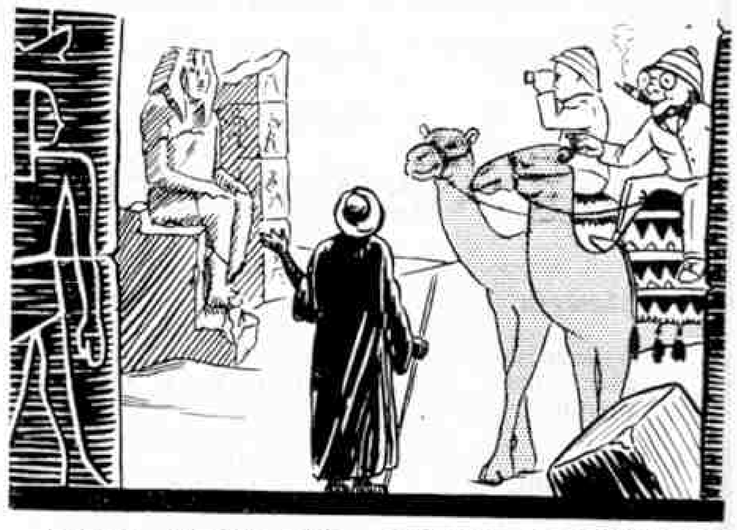
* * * *

Passenger: "There's no clock in my cabin, captain."

Captain: "Oh, that's all right. We keep a watch on deck."

* * * *

SIMPLE ARITHMETIC!



Guide: "These ruins, gentlemen, are 2,000 years old."

Mr. Newly Rich: "Now then, you can't fool me. It's only 1929 now."

* * * *

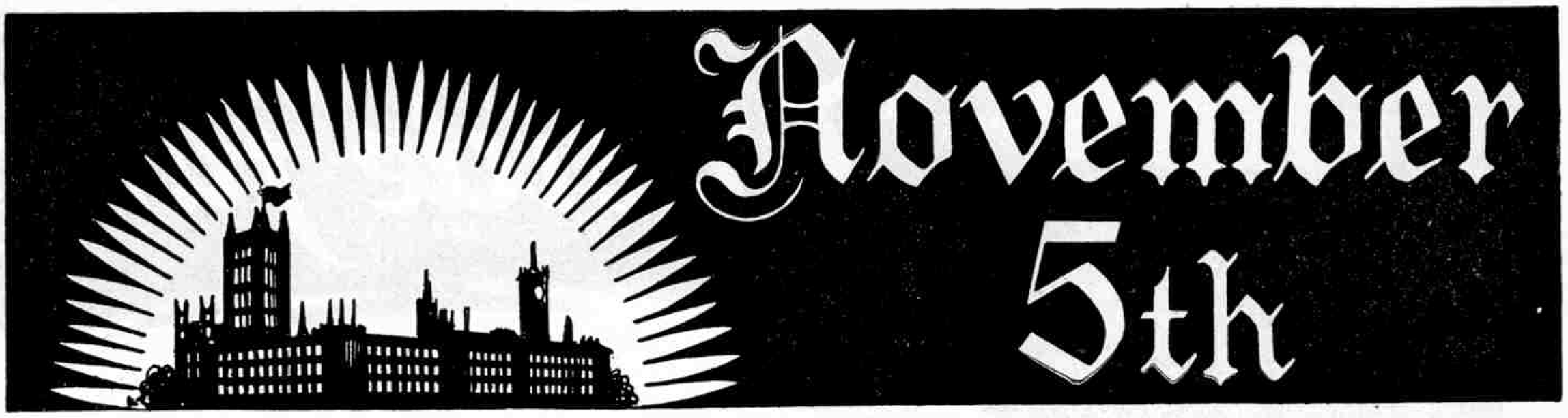
Shopkeeper: "Well, Tommy, what do you want to buy this time—more sweets?"

Tommy: "You bet I do, but I gotta buy some soap!" "*Everybody's Weekly.*"

* * * *

Policeman 666 suffered from an impediment in his speech, and was chaffed about it rather mercilessly. One day when reporting for duty, his worst tormentor, the sergeant, demanded his number.

The young man lost his temper. "Half a dozen, half a dozen, half a dozen," he shouted. "You thought I'd say thicx, thicx, thicx, didn't you?"



When you remember the date . . . .

and instinctively think of this "Guy" in whose infamous memory it is perpetuated . . . . . remember also that the finest fireworks obtainable are

BROCK'S CRYSTAL PALACE FIREWORKS

MADE ONLY BY C. T. BROCK & CO.'S "CRYSTAL PALACE" FIREWORKS LIMITED

The Oldest and Largest Makers in the World — *Established 1725*

LOTT'S BRICKS

MINIATURE STONE BUILDING BRICKS

All the dealers whose names appear below, hold full stocks of Lott's Bricks, and Tudor Blocks, and will gladly demonstrate them to you. With these bricks every boy can build realistic model Houses, Bridges, Railway Stations, Signal Boxes, Farm Buildings, etc.

ASK ALSO TO SEE LODOMO, A NEW LOTT'S BRICKS DEVELOPMENT

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" – – – E. A. McMillan Ltd.
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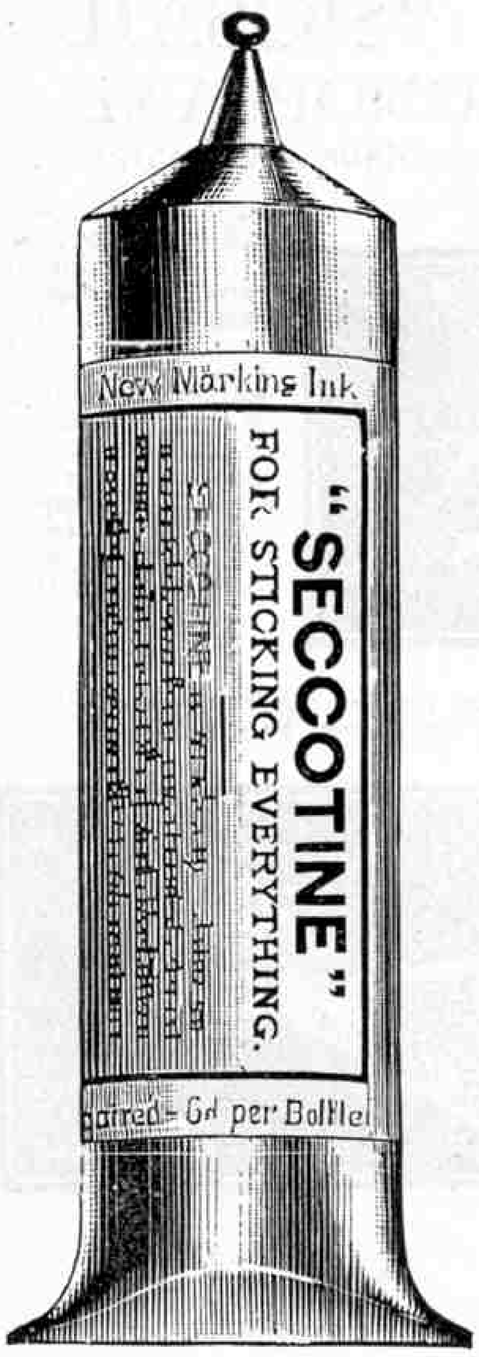


Every man, woman, boy or girl must and should have a tube of—

SECCOTINE

The World's Great Adhesive. **Registered Trade Mark.**

Children know its value. Some time ago we heard of

a boy, who, having his attention called to the beauty and long-standing of King's College Chapel at Cambridge, hazarded the opinion that it had been put together with Seccotine. We have heard, recently, too, of

a small girl, who thought the old nursery rhyme of "Sing a Song of Sixpence" might be improved by bringing Seccotine into it. It will be remembered that

The maid was in the garden, putting out the clothes,
When by came a blackbird and snapp'd off her nose.

The child, disliking this unhappy ending, supplied the lines which follow:

The King sent through the country
To find his wisest men,
They bought a tube of Seccotine,
And stuck it on again.

The Grown-ups have discovered endless novel uses for Seccotine. Of course, the great use of Seccotine is the making or mending of articles of wood, but the world is continually discovering and becoming enthusiastic over services which it is found Seccotine will unexpectedly render.

Seccotine is on sale all the world over, from China to Peru, in shops that are numberless.

PRICE 4½d., 6d. and 9d. PER TUBE

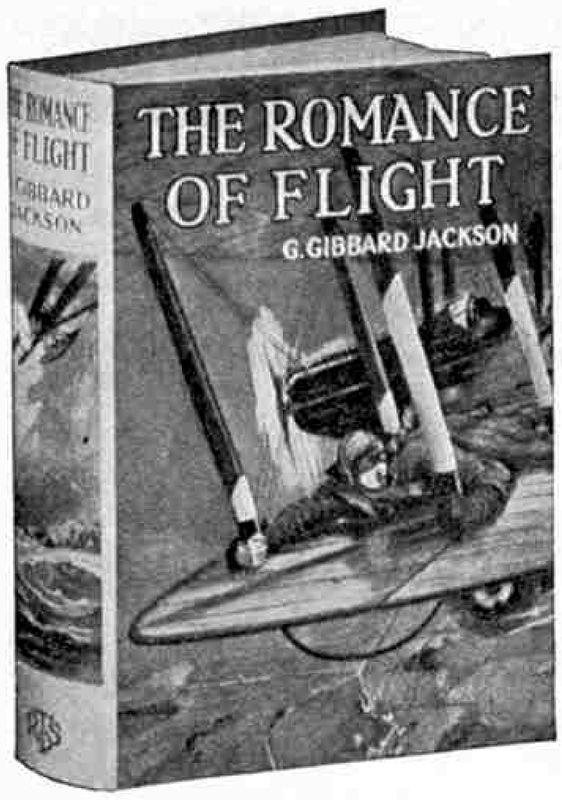
Bulk packages are supplied for manufacturing purposes.

Interesting booklet, free on application to:

McCAW, STEVENSON & ORR LIMITED
The Linenhall Works BELFAST

THE
ROMANCE OF FLIGHT
By G. GIBBARD JACKSON

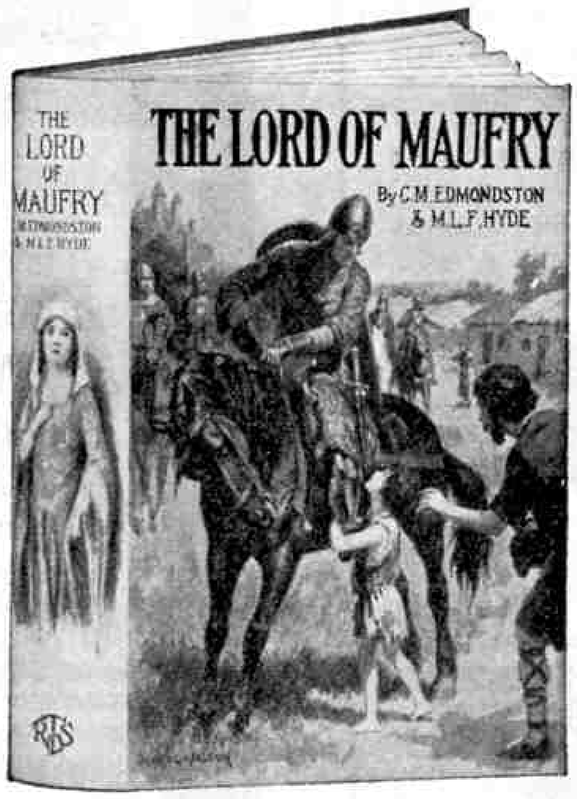
The complete and wonderful story of the air from the beginning of flight, dealing with balloons, airships, gliders, seaplanes, air taxis, air mails, air ports, etc.



5/-

THE
LORD OF MAUFRY
By C. M. EDMONDSTON and M. L. F. HYDE

An exciting tale of Normandy in the 12th century.
Alan the hero who is in turn serf, page and squire, finds his courage and ingenuity taxed in his endeavour to help the cause he serves.



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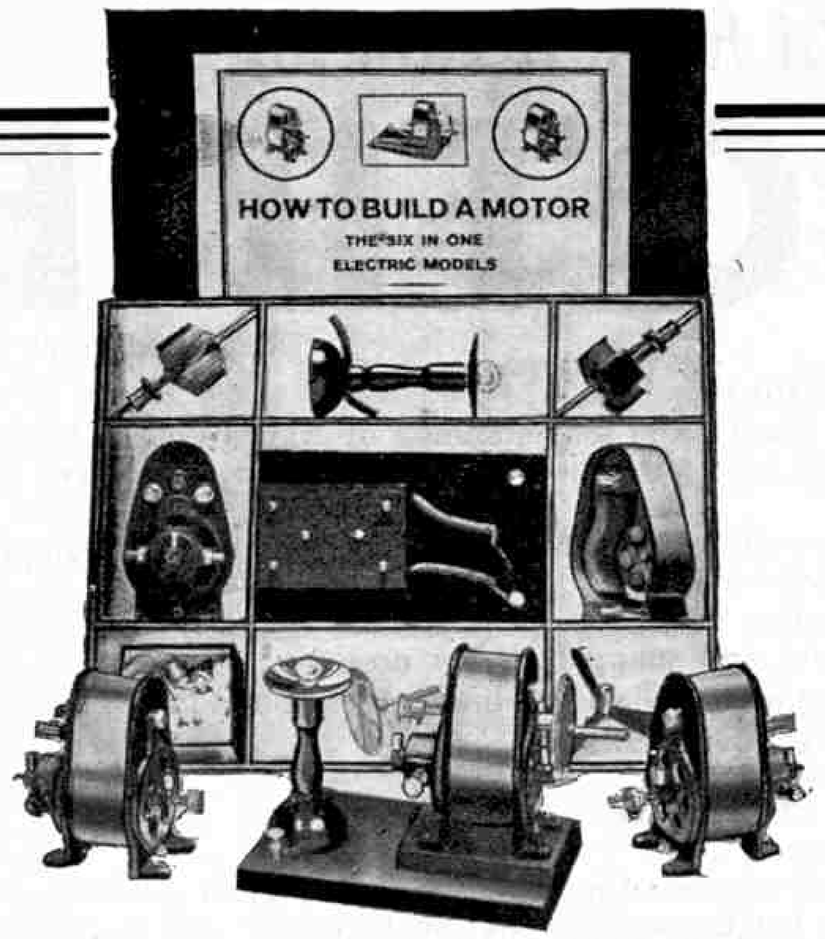

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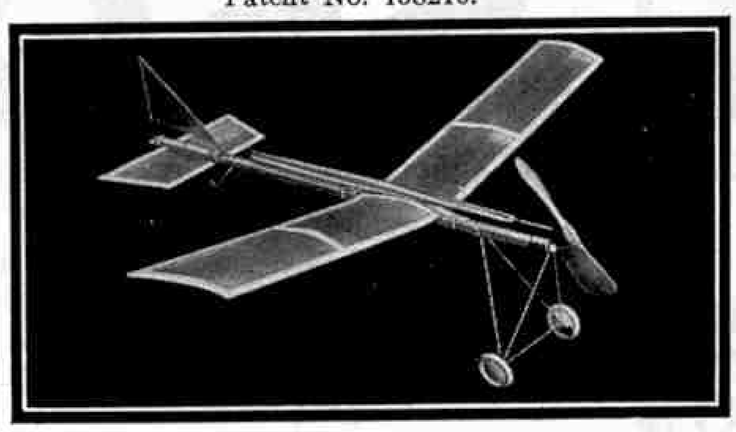

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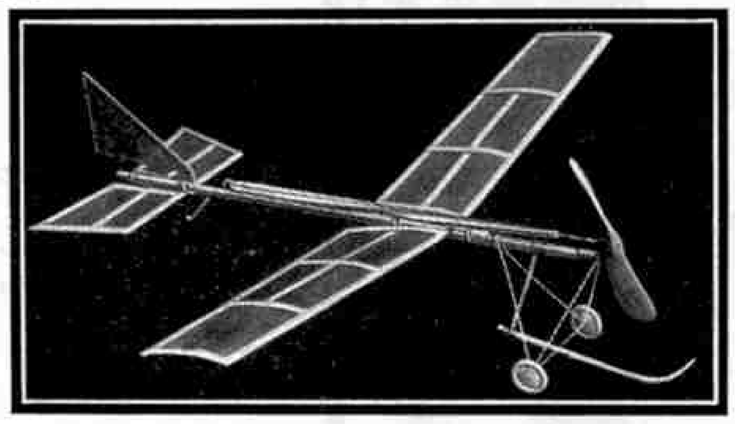

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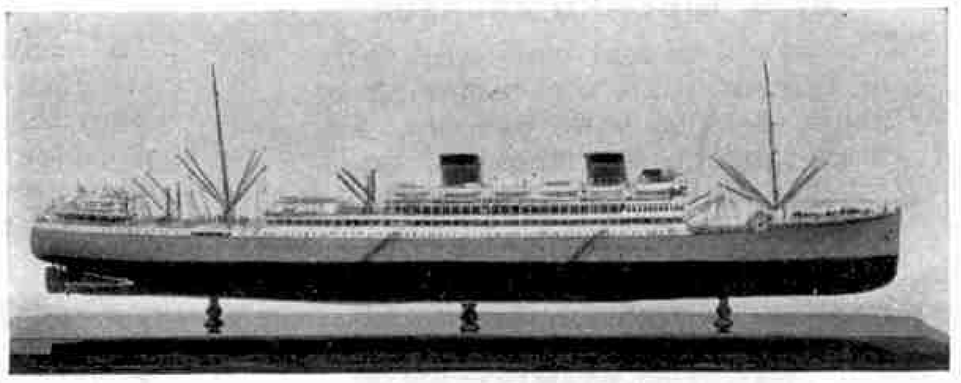

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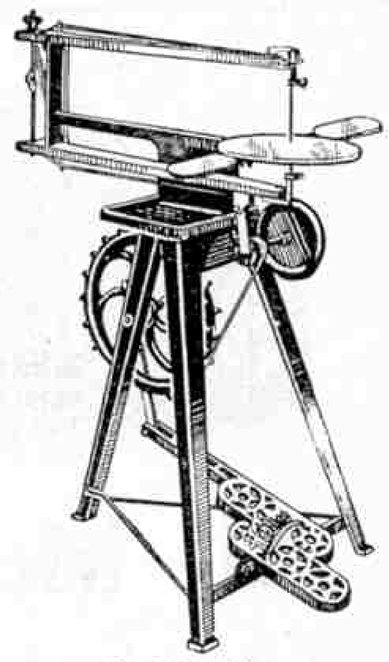

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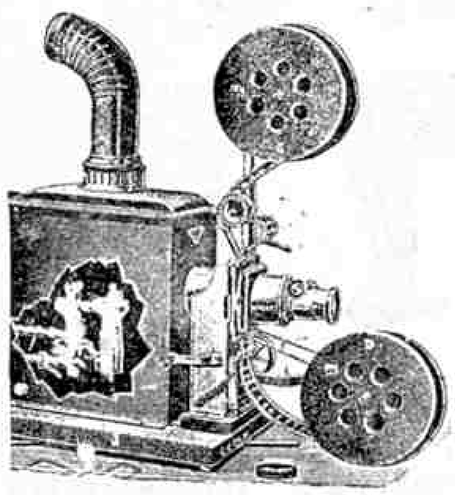

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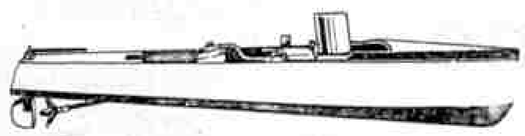

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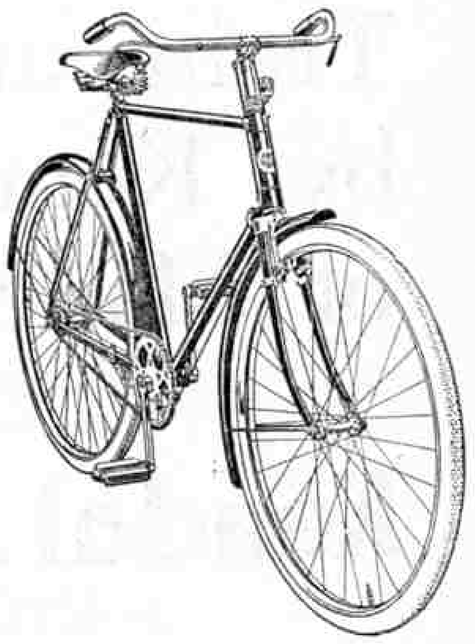

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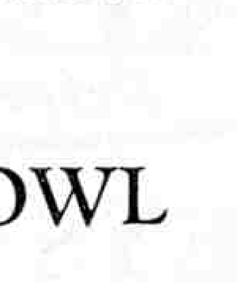

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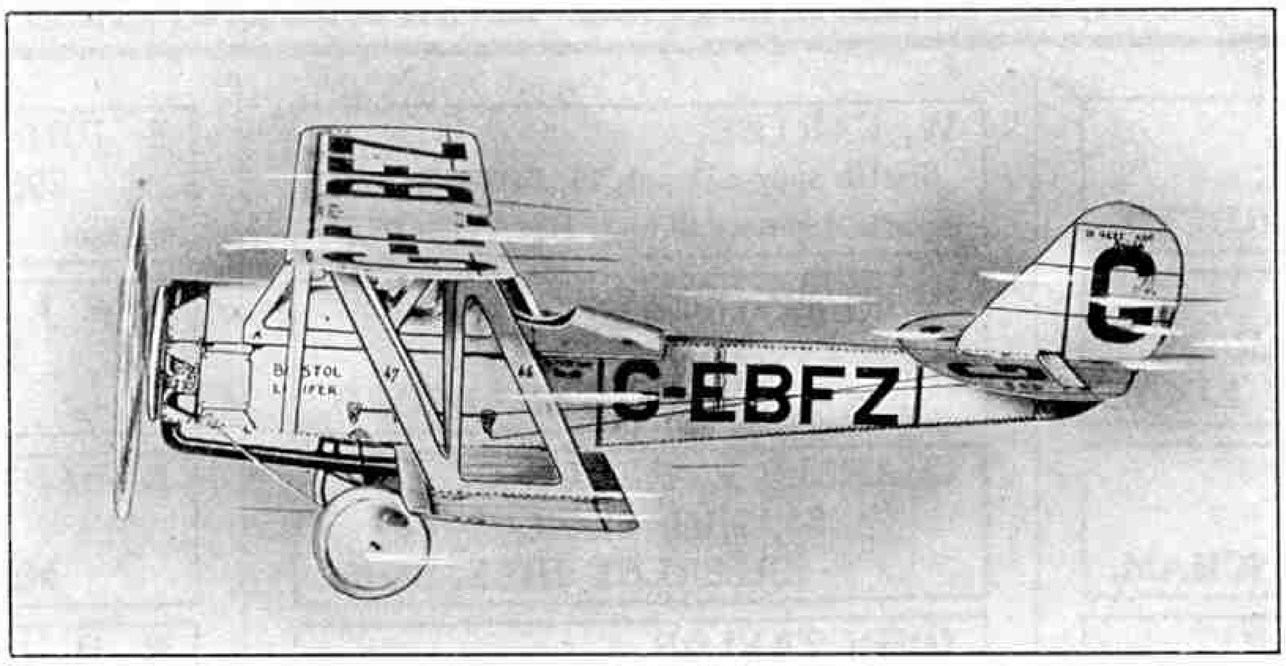

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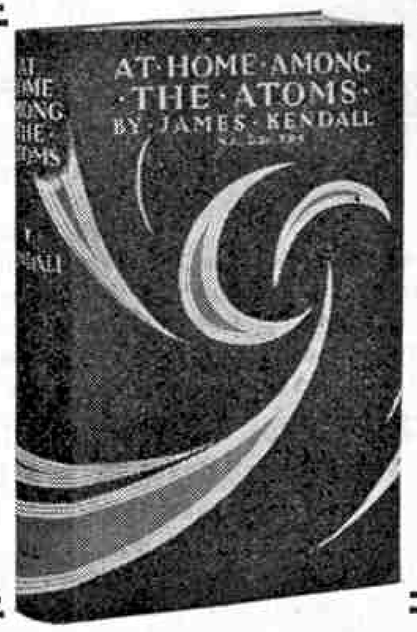

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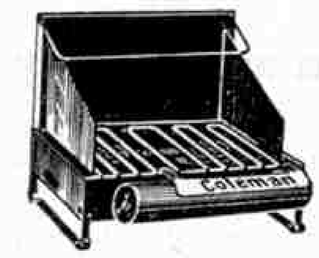

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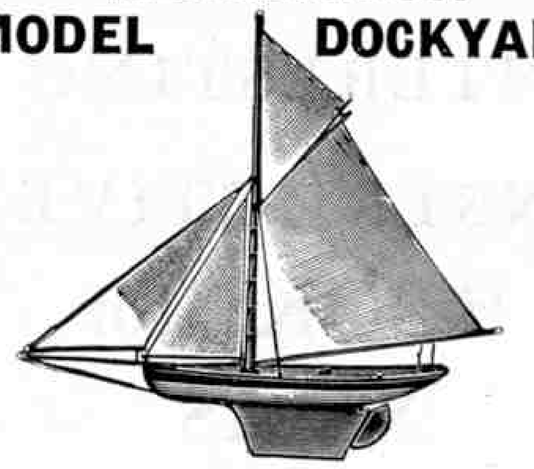

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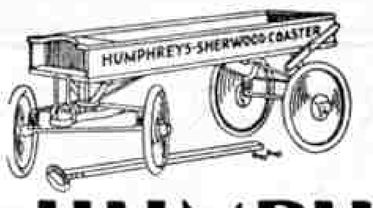

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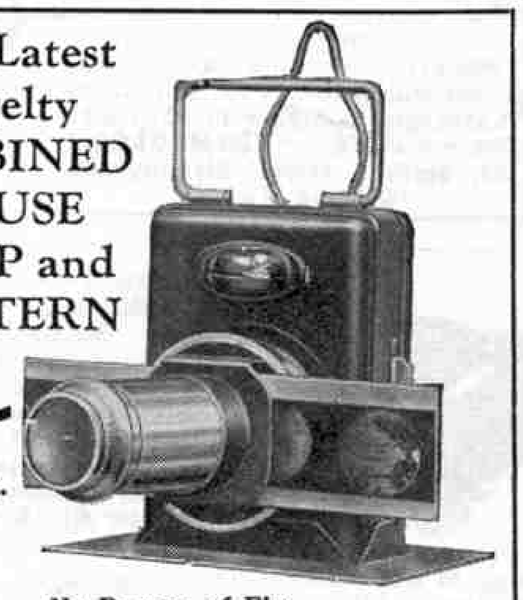

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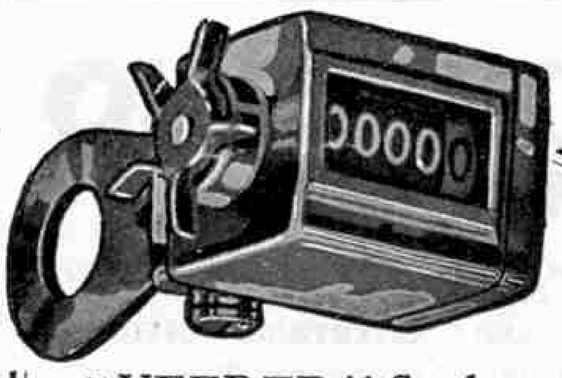

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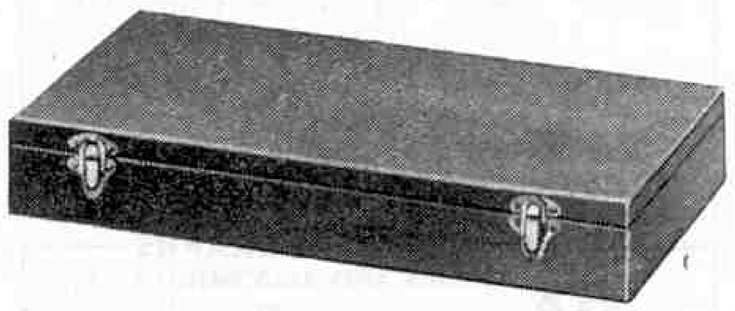

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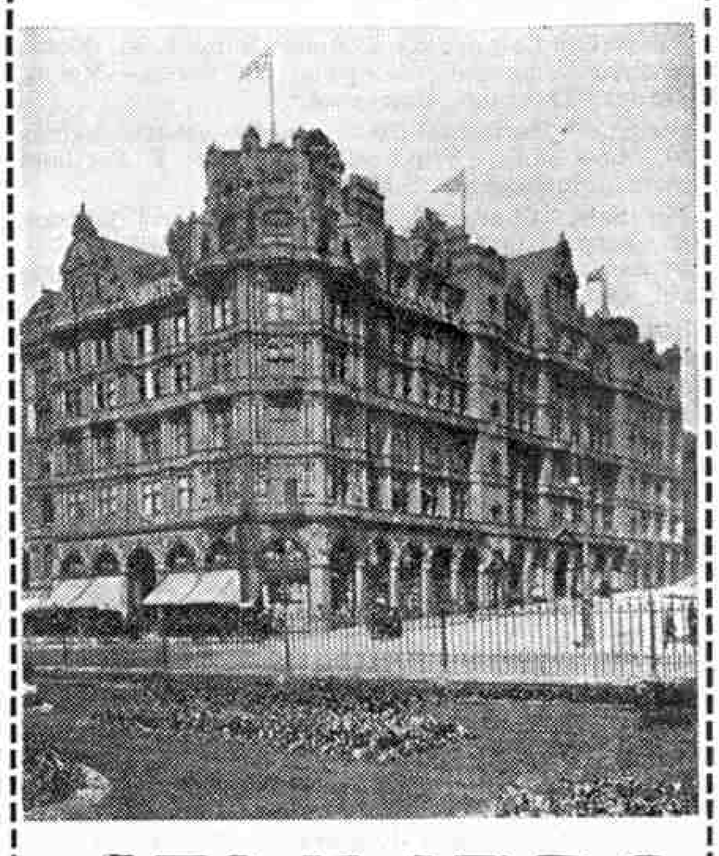

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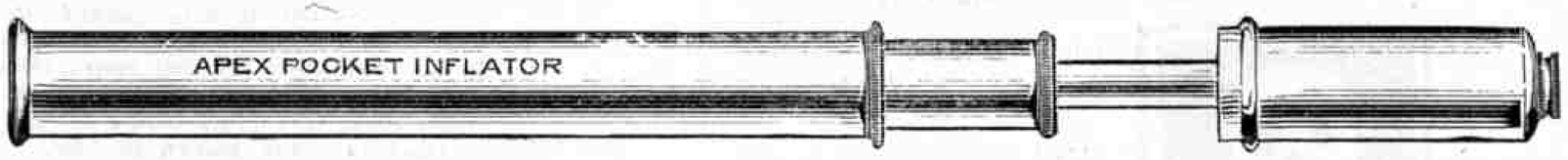

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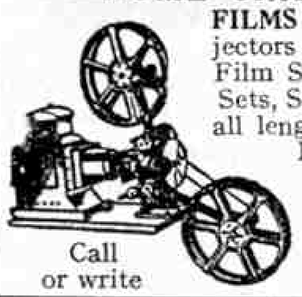

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EDITORIAL AND ADVERTISING OFFICES :—
BINNS ROAD, LIVERPOOL, ENGLAND.
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To Contributors. The Editor will consider articles and photographs of general interest and payment will be made for those published. Whilst every care will be taken of articles, etc., submitted, the Editor cannot accept responsibility for any loss or damage. A stamped addressed envelope of the requisite size should be sent where the contribution is to be returned if unacceptable.

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Readers Overseas and in foreign countries may order the "*Meccano Magazine*" from regular Meccano dealers, or direct from this office. The price and subscription rates are as above, except in the cases of Australia, where the price is 1/- per copy (postage extra), and the subscription rates 7/- for six months and 14/- for 12 months (post free); Canada, where the price is 15c. per copy, and the subscription rates 75c. for six months, and $1.50 for 12 months (post free).

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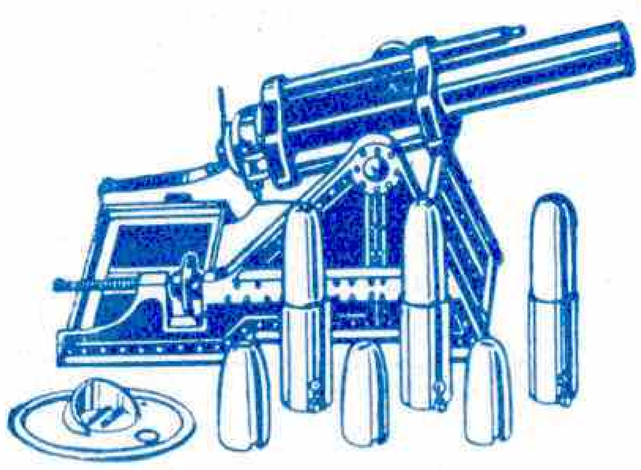

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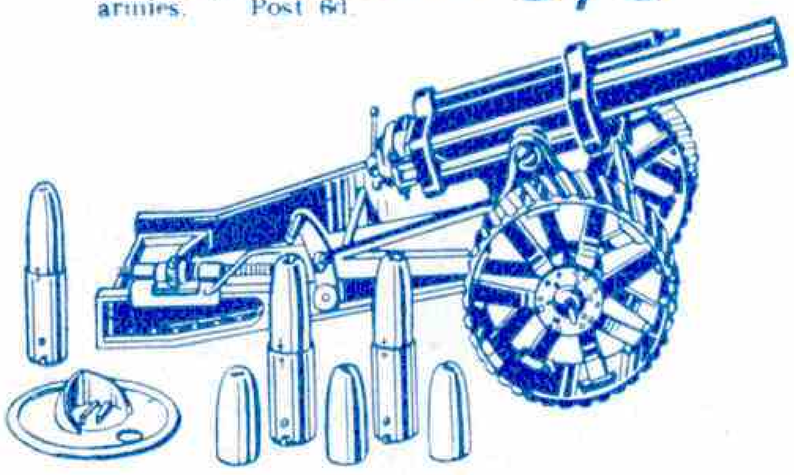

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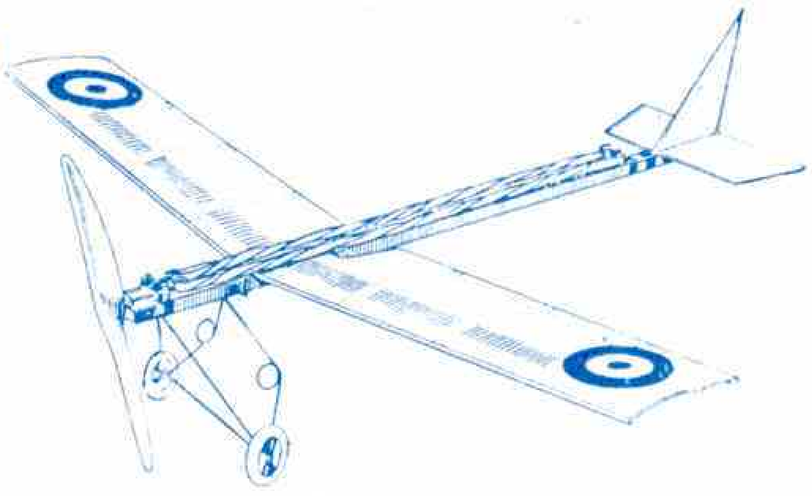

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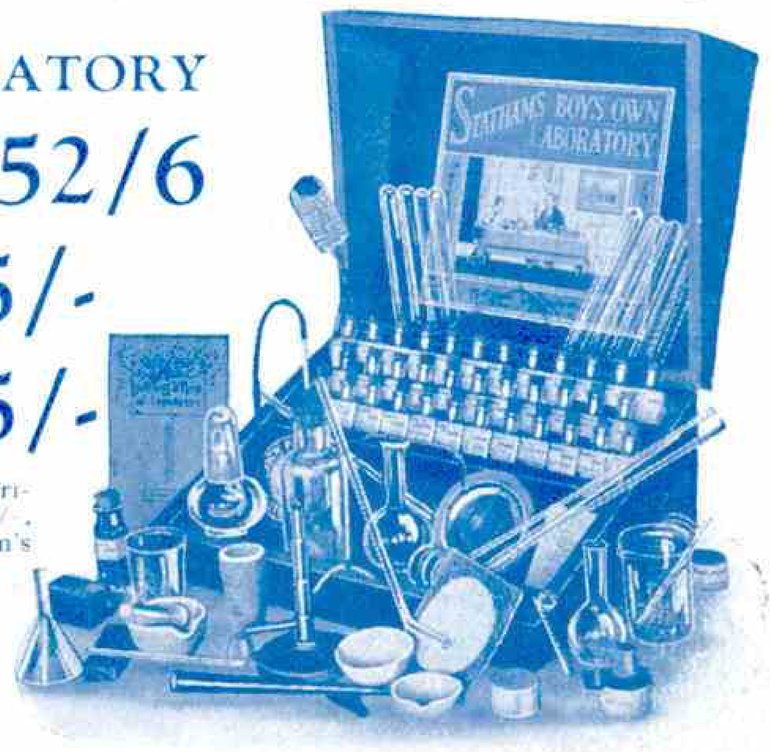

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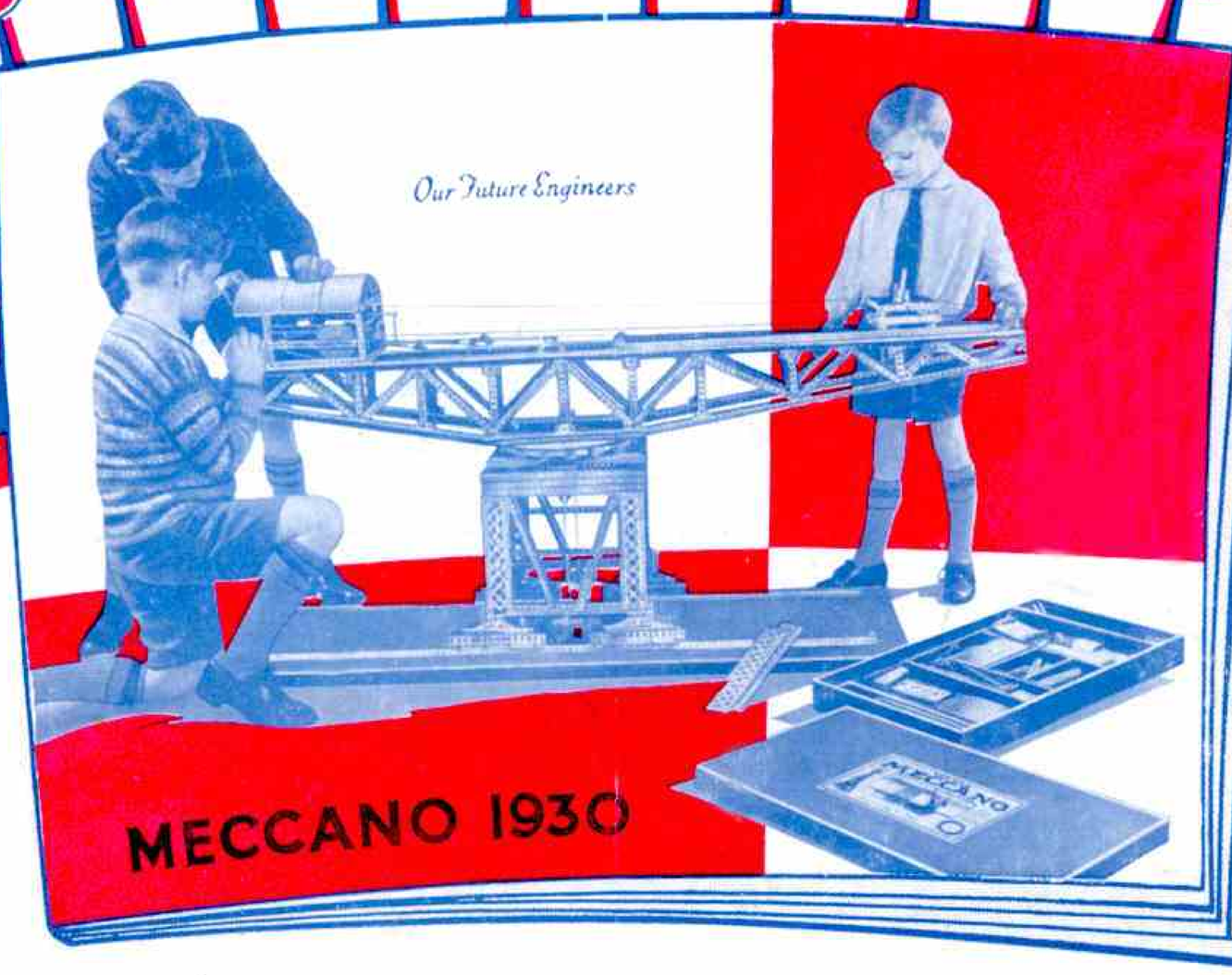

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